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BIOLOGICAL RESULTS OF THE UNIVERSITY OF MIAMI DEEP-SEA EXPEDITIONS. 130. THE SYSTEMATICS AND ZOOGEOGRAPHY OF THE GASTROPOD FAMILY TROCHIDAE COLLECTED IN THE STRAITS OF FLORIDA AND ITS APPROACHES

James F. Quinn, Jr.

Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, U.S.A.

ABSTRACT

Fifty-four species of molluscs in the family Trochidae are reported from the Straits of Florida in depths of 180 m or more. The following new taxa are described: *Echinogurges,* n. gen. (type-species *Trochus* (*Margarita*) *clavatus* Watson); *Mirachelus clinocnemus,* n. sp.; *Solariella* (*Solariella*) *multirestis,* n. sp.; *Microgaza rotella inornata,* n. subsp. *Microgaza vetula* Woodring is reported from the Recent fauna for the first time. The radula of *Microgaza rotella rotella* Dall is described and illustrated for the first time and indicates that *Microgaza* is in the subfamily Solariellinae. Each species, except those in the genera *Gaza, Calliostoma* and *Lischkeia,* is fully described and illustrated with photographs, and synonymies and distributions are given. A zoogeographic analysis indicates that the trochid fauna is a tropical deep-sea assemblage.

INTRODUCTION

The molluscan fauna of the Straits of Florida has been extensively, if sporadically, sampled, beginning with the BLAKE expeditions (1877–78, 1878–79, 1880) and continuing to 1972, when the R/V GERDA was retired from service by the University of Miami. The identification of species from this area has been based primarily on the work of William Healey Dall (1881, 1889, 1927a,b). The majority of his work was excellent, but he often worked with scanty collections and inadequate literature, and mistakes and discrepancies often appeared. Despite this, subsequent authors have generally accepted Dall's opinions uncritically, especially in the archaeogastropod family Trochidae. Since Dall, several descriptive works and a few faunal lists have included species found in the Straits, but except for a study of *Gaza* (Clench & Abbott, 1943) and a monograph of the genus *Calliostoma* (Clench & Turner, 1960), no critical work has been attempted involving trochids found in the Straits. Since the GERDA collections were rather rich in trochids, this study was selected to fill a considerable gap in the systematic literature of the Trochidae.

This study treats those species of Trochidae which have been taken in depths greater than 180 m in the Straits of Florida and deals with the systematics and zoogeography of this rather important group. The depth limitation eliminates 11 shallow-water species from consideration in the systematic account, but for the sake of completeness, 10 of these are included in the zoogeographic considerations.

LITERATURE REVIEW OF STRAITS TROCHIDAE

In the first hundred years after Linnaeus's 10th edition of *Systema Naturae* was published, 8 species of trochids assignable to the Straits fauna were described. Linnaeus (1758), Born (1778), Lamarck (1822) and Arthur Adams (1854) each described 1 species, and Gmelin (1791) and C. B. Adams (1845, 1850) contributed 2 species apiece. All 8 are shallow water species, and only 2 (*Calliostoma jujubinum* Gmelin and *C. pulchrum* C. B. Adams) can be included in this study.

The first deep water trochid to be attributed to the Straits area *per se* was *Solariella amabilis* (Jeffreys, 1865), a name Dall used for *Solariella pourtalesi* Clench & Aguayo, 1938. *S. amabilis* is now known to be strictly an Eastern Atlantic form. Watson (1879, 1886), in working up the CHALLENGER gastropods, reported 14 new Western Atlantic species, of which 7 are found in the Straits (in 1886 he added a fifteenth, *Margarites euspira* Dall, 1881). Verrill (1880) reported on the molluscs collected by the FISH HAWK and in-

cluded 3 new Western Atlantic trochid species, of which 1, *Solariella lamellosa* (Verrill & Smith, 1880) is also found in the Straits.

In working up the molluscs of the BLAKE and ALBATROSS expeditions, William Healey Dall was primarily responsible for laying the groundwork on which most of the Western Atlantic molluscan research is based. In his preliminary report on the BLAKE collections (1881) Dall recognized 24 species of Trochidae, 19 of which were new and 14 which are now known from the Straits. His 1889 paper, the comprehensive report on the Caribbean molluscs from the BLAKE expeditions, added 13 new species, and 34 of the 45 trochids discussed are found in the Straits. A preliminary report on the ALBATROSS expedition of 1887–1888 listed 10 species, 5 now recorded from the Straits. Finally, 2 papers on ALBATROSS material from off southern Georgia (Dall, 1927a, 1927b) produced 29 species of which 23 were new and 10 occur in the Straits.

A series of papers by Clench & Aguayo (1938, 1939, 1940, 1941, 1946) introduced 11 new species of trochids, mostly in the genus *Calliostoma,* and 7 of the species were taken in the Straits. Papers by Schwengel & McGinty (1942) and Schwengel (1951) added 2 new shallow water species of *Calliostoma,* and Clench & Abbott (1943) treated 3 species of *Gaza* known from the Straits area. Rehder (1955) redescribed *Turcicula imperialis* Dall, and discussed the relationships of *Turcicula* to *Lischkeia, Bathybembix,* and *Calliotropis.*

Clench & Turner (1960) produced a comprehensive monograph of the Western Atlantic *Calliostoma,* and included a section dealing with species which were originally described as *Calliostoma,* but are doubtfully in that genus, or assigned to some other genus entirely. In all, they dealt with 56 species of which 23 are known from the Straits area. Finally, Bayer (1971) reviewed 59 species of molluscs from the tropical West Atlantic and included 8 species of trochids (five from the Straits).

A few lists of molluscs have been published which include species of the Straits fauna. The most important are Dall's (1885, 1889b) and Johnson's (1934). A work which is helpful only as a list is Abbott (1974). Another useful work is Pilsbry (1889) in the *Manual of Conchology,* in which he compiled the original descriptions and citations for as many trochid species as possible on a worldwide basis, and brought together most of the illustrations then available.

MATERIALS AND METHODS

Material for this study came from collections made by a variety of ships. The bulk of these collections is deposited at the University of Miami and the U.S. National Museum, with a lesser amount of material in the Museum of Comparative Zoology, Harvard University. The major portion of the collections was made aboard the USCGS BLAKE (1877–1880), the U.S. Fish Commission Ship ALBATROSS (1883–1887), John Henderson's yacht EOLIS (1910–1917), the ATLANTIS (1938–1939), and the R/V GERDA of the University of Miami (1962–1972). Additional specimens from the Caribbean were obtained by the State University of Iowa Expedition to Barbados and Antigua (1918) with the launch EOLIS jr, and by the University of Miami aboard the R/V JOHN ELLIOTT PILLSBURY.

The collecting gear used by the expeditions is quite varied. The BLAKE and ALBATROSS used primarily the beam trawl and a modified beam trawl known as the BLAKE trawl, which fished equally well on either side. Several types of dredges were also used upon occasion aboard the BLAKE and ALBATROSS. John Henderson, aboard the EOLIS and EOLIS jr used, almost exclusively, a small box-type dredge. The ATLANTIS used 10-ft and 14-ft BLAKE trawls and 35-ft, 52-ft and 60-ft otter trawls. The GERDA employed several types of gear, primarily the 10-ft otter trawl or "try net." A 16-ft otter trawl was used briefly from the GERDA, but was soon discarded since it was rather unwieldy aboard the GERDA and it merely caught larger quantities of species taken by the try net. Several types of dredges were employed, including a box dredge, pipe dredge and triangular dredge, but their use was discontinued primarily for reasons of economy. They did not obtain large enough collections to warrant the time and energy expended. An accidental bottoming of a 6-ft Isaacs-Kidd Midwater Trawl obtained a rather rich collection of small molluscs. For a detailed description of the GERDA and her gear, see Devany (1969) and Staiger (1970). The PILLSBURY worked primarily in the Caribbean Sea, using the 10-ft and 40-ft otter trawls, and occasionally a 5-ft BLAKE trawl.

The dredges are, without doubt, the best gear for obtaining the minute molluscs, including those which burrow shallowly. However, the area sampled is necessarily small, and in deep-sea surveys, they are inadequate. The BLAKE and beam trawls are better, but still

somewhat uneconomical for extensive use in the deep-sea. Therefore, since the 1930's, most work has been done with the otter trawl. The limitation on the otter trawls is that, although capturing the larger organisms adequately, the very small organisms are often washed through the mesh of the net and only part are retained. It is difficult to make any assumptions as to the relative abundance of individuals at any station. The small molluscs are also frequently overlooked in sorting the catch, and unless the debris and sediment are saved and sorted under magnification, many specimens could be lost.

For the literature used in identifying the specimens, see Literature Review section. In addition to the primary literature, many smaller, less comprehensive papers were consulted to verify identifications, check synonymies, and compile distributional data. Types of several species were kindly loaned by Dr. Kenneth J. Boss of the MCZ. Finally, two trips were made to the USNM to examine the types of all the Western Atlantic trochids deposited there, and to compare many of the RSMAS specimens with material in the USNM collections. In addition to the Jeffreys collection, the USNM collections contain most of the material from the BLAKE and ALBATROSS expeditions, the entire Henderson collection, as yet largely unidentified, and the State University of Iowa Expedition collections. These afforded numerous lots of material from the Straits of Florida and the Caribbean.

A WILD M-5 binocular dissecting microscope was used for examination of all specimens and a camera lucida attachment was used for preliminary drawings of many of the smaller species and comparison with similar species. A WILD M-20 compound microscope was used for examination of radular preparations.

Radulae were removed by soaking the specimen in hot KOH to dissolve the tissue. They then were washed and mounted in Euparal on a microscope slide. Shell measurements were made with dial calipers graduated in tenths of millimeters. All measurements are given in millimeters and depths are in meters.

All photographs were taken with a PENTAX SP II 35 mm SLR camera using KODAK Panatomic-X film. A bellows attachment and 2x teleconverter were used when photographing specimens less than 10 mm in height. A ROLLEI E-27 strobe unit was used for primary lighting and a white card reflector was placed behind the specimen for fill-in lighting.

Measurements given in the descriptions are the total height of the specimen unless otherwise noted.

Abbreviations used in the paper are as follows:

RSMAS—Rosenstiel School of Marine and Atmospheric Science
USNM—U.S. National Museum of Natural History
MCZ—Museum of Comparative Zoology, Harvard University
ANSP—Academy of Natural Sciences, Philadelphia
UMML 30-0000—University of Miami Marine Lab. gastropod accession number
G-0000—R/V GERDA Station number
P-0000—R/V PILLSBURY Station number
OT—Otter Trawl
IKMT—Isaacs-Kidd Midwater Trawl
J-S—Johnson-Smithsonian Deep-Sea Expedition to the Puerto Rico Deep in 1933
SUI—State University of Iowa Barbados-Antigua Expeditions, 1918.

The synonymies cited in the Species Account are, for the most part, complete. Some minor lists have been omitted, and recent popular and semi-popular guides and identification manuals have not been included with the exception of Abbott's *American Seashells* (1974). This was included since most of the species treated here are listed, and the work enjoys a very wide following, both amateur and professional. With the exception of species of *Calliostoma* and *Gaza,* all species have been redescribed and figured since the species are poorly known and the original descriptions were often inadequate or misleading, and relatively inaccessible without an extensive literature search. Types of almost all species were traced and examined. Those which were not examined are noted under *Types* section on the species description.

The *Material Examined* sections of the species descriptions are in abbreviated form, consisting of a vessel or expedition station number followed by the number of specimens in the lot and the museum accession number of the lot. Miscellaneous collections, such as those by the EOLIS, are accompanied by complete data. Complete data for the abbreviated notations are included in the Appendix.

Area of Study.—For the purposes of this study, the Straits of Florida are defined as follows: bounded on the north by 27°30′N, on the east by the Bahamas or 78°30′W, on the

west by the Florida peninsula and out to 83°30′W, and on the south by the northern coast of Cuba. The approaches to the Straits are the Yucatan Channel, Nicholas Channel, Santaren Channel, and the Northwest Providence Channel. This is a somewhat arbitrary demarcation, selected primarily to agree with previous studies of the fauna of the Straits (Robins, 1968; Devany, 1969; Staiger, 1970; Cairns, 1973; Messing, 1975). In these reports, the various physical, geological and hydrographical aspects of the Straits have been extensively summarized. Therefore, only the following brief description of the area is presented:

The Straits of Florida are an arcuate, sloping trough, separating the Florida Plateau from the Bahama Platform and Cuba, and forming the bed of the Florida Current. The thalweg of the trough descends from a northern sill located about 27°25′N at a depth of just over 700 m. The slope is at first slight (0.4 m/km), descending to a broad, flat plateau with a depth of 860–878 m just north of the Cay Sal Bank. In the Cay Sal area the thalweg assumes a much steeper gradient (up to 5 m/km), descending to about 2800 m at its junction with the extreme southeastern Gulf of Mexico. The axis of the Straits from Cay Sal to the Gulf of Mexico extends roughly to the west. Here the bottom topography also becomes very rugged.

The Yucatan Channel separates Cuba and Yucatan and permits the passage of water from the northwestern Caribbean Sea into the Gulf systems and the Florida Current. The southeastern Straits is divided into 2 subsidiary channels, the Nicholas and Santaren Channels, by the Cay Sal Bank. To the southeast these 2 channels merge to form the Old Bahama Channel which separates Cuba and the Bahama Platform. The Northwest Providence Channel enters the Straits from the northeast, dividing the Bahamas Platform into the Great and Little Bahama Banks. To the north of the Straits, the Blake Plateau extends to the northeast and descends gradually to a depth of about 1500 m, from whence the bottom drops suddenly to the floor of the Atlantic (about 3700 m).

Detailed descriptions of the various physiographic features of the Straits are presented in Jordan & Stewart (1961), Jordan et al. (1964), Kofoed & Malloy (1964) and Malloy & Hurley (1970). Summaries of the hydrography of the Straits may be found in Wennekens (1959), Devany (1969) and Cairns (1973). Messing (1975) gave an extensive summary of all aspects of the oceanography of the Straits.

SYSTEMATICS

The higher classification used in this study is primarily based on that of Thiele (1929) and modified by Keen (1960) and McLean (1971).

Phylum MOLLUSCA
Class GASTROPODA Cuvier, 1797
Subclass Prosobranchia A. Milne-Edwards, 1848
Order Archaeogastropoda Thiele, 1925
Suborder Trochina Cox & Knight, 1960
Superfamily Trochacea Rafinesque, 1815
Family Trochidae Rafinesque, 1815
Subfamily Margaritinae Stoliczka, 1868
Genus *Margarites* Gray, 1847
Genus *Calliotropis* Seguenza, 1903
Genus *Lischkeia* Fischer, 1879
Genus *Euchelus* Philippi, 1847
Genus *Mirachelus* Woodring, 1928
Genus *Echinogurges* gen. nov.
Subfamily Umboniinae Pilsbry, 1886
Genus *Gaza* Watson, 1879
Subfamily Calliostomatinae Thiele, 1924
Genus *Calliostoma* Swainson, 1840
Genus *Dentistyla* Dall, 1889
Subfamily Solariellinae Powell, 1951
Genus *Solariella* S. V. Wood, 1842
Genus *Microgaza* Dall, 1881

Subfamily Margaritinae Stoliczka, 1868

Genus **Margarites** Gray, 1847

Margarita Leach, 1819: 464 (*non* Leach, 1814).
Margarites Gray, 1847b: 268.
Eumargarita Fischer, 1885: 825.
Valvatella Melville, 1897: 472 (*non* Gray, 1857).

Type-species.—*Trochus helicinus* Fabricius, 1780; by original designation, Gray, 1847b: 268.

Diagnosis.—Shell small, usually nacreous, conical or rather depressed, smooth or spirally striate, with rounded whorls, usually umbilicate. Radula rhipidoglossate; rhachidian with a single, laterally serrate cusp; laterals 4 to 6, serrate on the outer edges; marginals numerous, similar in size and form to the laterals.

Subgenus **Bathymophila** Dall, 1881

Bathymophila Dall, 1881: 102; 1889a: 378; 1889b: 162.—Pilsbry, 1889: 306.—Johnson, 1934: 73.—Abbott, 1974: 37.

Type-species.—*Margarita euspira* Dall, 1881; by monotypy, Dall, 1881: 102.

Diagnosis.—Shell with or without a subsutural row of nodules; columella broad, flattened, granular in young specimens; umbilicus closed by callus.

Margarites (Bathymophila) euspira
(Dall, 1881)
Figs. 1,2

Margarita (?) *euspira* Dall, 1881: 44.
Margarita (Bathymophila) euspira: Dall, 1881: 102; 1889a: 378, pl. 32, fig. 8; 1889b: 162, pl. 32, fig. 8 (listed only; fig. from 1889a).—Pilsbry, 1889: 306, pl. 51, fig. 24; pl. 47, figs. 1–3 (description from Dall, 1881; figs. from Dall, 1889a and Jeffreys, 1883).
Margarita (Bathymophila) euspira var. *nitens* Dall, 1881: 102.
Trochus (Oxystele) euspira: Jeffreys, 1883: 98, pl. 20, fig. 6.—Watson, 1886: 68.
Trochus (Oxystele) euspira var. *coronata* Jeffreys, 1883: 99.
Margarites (Bathymophila) euspira: Johnson, 1934: 73 (listed only).
Margarites (Bathymophila) euspirus: Abbott, 1974: 37, fig. 237 (listed only; fig. from Dall, 1889a).

Description.—Shell small (attaining a height of about 7 mm), bluntly conical, polished, white with an underlying iridescence, of about 6 rounded whorls. Protoconch small, glassy, of about 1½ whorls. First 2 whorls with 6 to 8 strong spiral cords which generally become obsolete on later whorls; cord nearest the suture often persisting as a row of obscure to prominent nodules. Whorls following the 2nd generally smooth and polished, with only fine growth lines. Base rounded; umbilicus open in young specimens, filled by columellar callus in mature specimens. Aperture obliquely ovate; outer lip thin and simple; columella thick, flattened, broad at its base, with a small obscure tubercle above a shallow subterminal hollow.

Holotype.—Not traced.

Type-locality.—BLAKE sta. 2, 23°14′N, 82°25′W, off Havana, Cuba, 1472 m.

Material examined.—Blake, sta. no. unrecorded, Yucatan channel, 1170 m; 1, MCZ 7576; 5, MCZ 7577.

Geographic distribution.—This is an amphi-Atlantic species which occurs in the Eastern Atlantic in Vigo Bay off northern Portugal and in the Western Atlantic in the southern Straits of Florida, the Yucatan Channel, and the Virgin Islands.

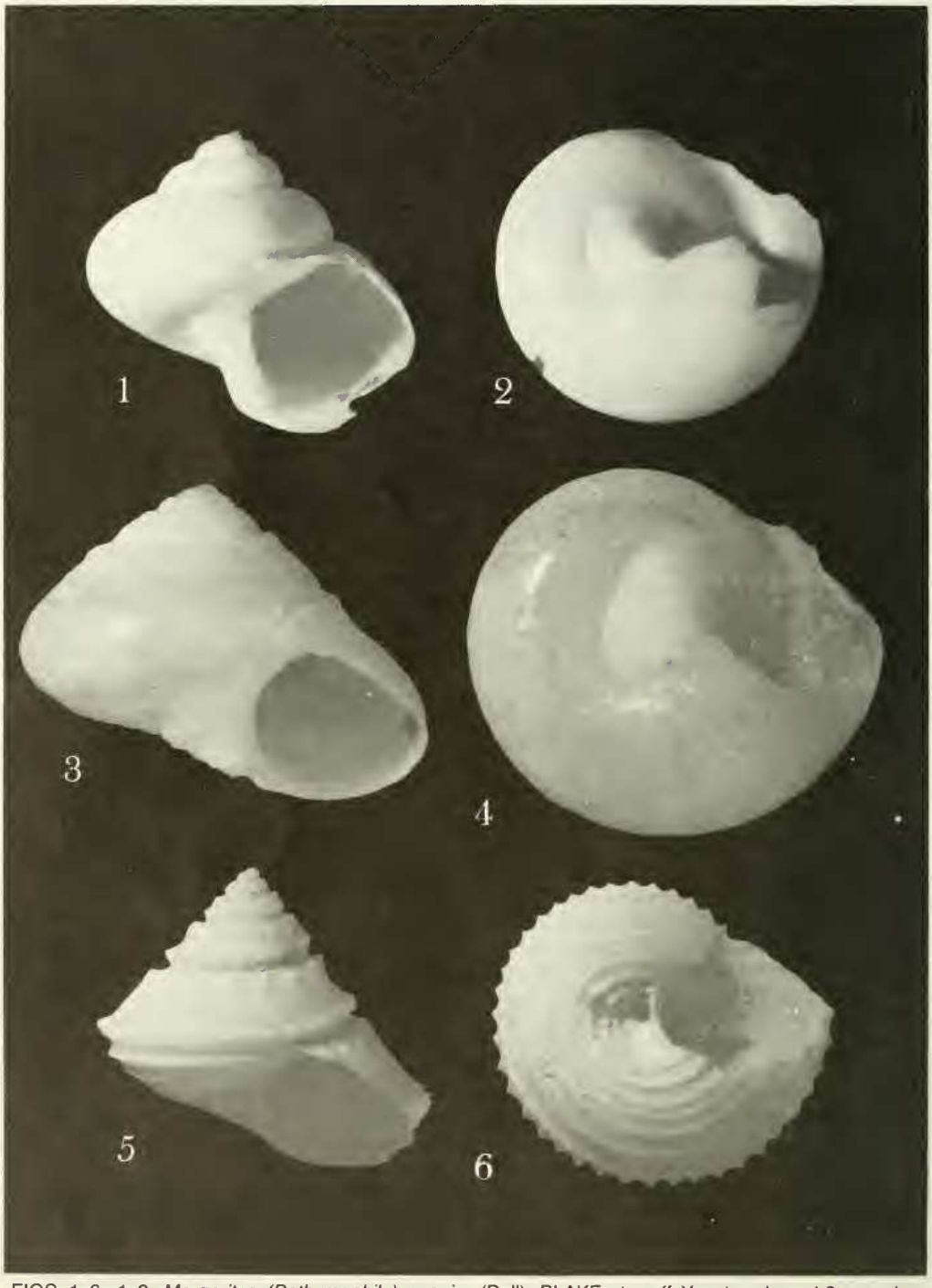
Bathymetric range.—Known in the Eastern Atlantic from 1353 to 2003 m, and in the Western Atlantic from 713 to 1472 m.

Remarks.—This species is rather variable in sculpture. The usual form is devoid of any sculpture other than the row of obscure beads at the suture. Some forms exhibit spiral cords over the whole shell, some have a strongly coronated subsutural cord (variety *coronata* Jeffreys, 1883), and others are lacking the subsutural band entirely (variety *nitens* Dall, 1881). The relationships of this species are unclear at present. It appears to be closest to the *"Umbonium" bairdi* of Dall, which is not an *Umbonium*. *M. euspira* also bears a superficial resemblance to *Solariella lubrica* Dall (*q.v.*), but they are not closely related. Whether or not *M. euspira* belongs in *Margarites* must await examination of the radula.

Margarites (Bathymophila) bairdi
(Dall, 1889)
Figs. 3,4

Umbonium bairdii Dall, 1889a: 359, pl. 21, figs. 6, 6a; 1889b: 160, pl. 21, figs. 6, 6a (listed only; figs. from 1889a).—Pilsbry, 1889: 457, pl. 60, figs. 5, 6 (description and figs. from Dall, 1889a).—Johnson, 1934: 74 (listed only).—Abbott, 1974: 40, fig. 270 (listed only; fig. from Dall, 1889a).

Description.—"Shell small, depressed conic, white, polished, externally porcellanous, internally slightly nacreous; nucleus globular, dextral; whorls five or more. Radiating sculpture of occasional faint impressed incremental lines; spiral sculpture of occasional microscopic striae, and a single strap-like band appressed to the suture, and bearing numerous flattish squarish nodules or elevations, which coronate the whorls; periphery rounded, base rounded, depressed in the centre, which is nearly filled with a mass of white callus having a very finely granular surface. Aperture ovate, margin simple, thin, oblique." (Dall, 1889a: 359.)



FIGS. 1–6. 1–2. *Margarites (Bathymophila) euspira* (Dall): BLAKE sta. off Yucatan, h = 4.9 mm, d = 5.6 mm. 3–4. *Margarites (Bathymophila) bairdi* (Dall) (holotype): ALBATROSS sta. off "Florida Reefs," h = 3.9 mm, d = 5.3 mm. 5–6. *Calliotropis (Calliotropis) ottoi* (Philippi): USNM 179612.

Holotype.—USNM 95064, from an unspecified ALBATROSS Station off the Florida Reefs.

Type-locality and *Material examined.*—ALBATROSS (sta. number unspecified), off the Florida Reefs; 1, USNM 95064 (holotype).

Geographic distribution.—Known only from the Straits of Florida and the Yucatan Channel.

Bathymetric range.—366 to 1170 m.

Remarks.—Several workers have commented that this species is probably not an *Umbonium,* an opinion with which I agree. *U. bairdi* appears to have an affinity with *Margarites (Bathymophila) euspira* Dall, at least in external shell characters. Both have spiral cords on the first whorls, the subsutural row of beads in *U. bairdi* is quite similar to that exhibited by *M. euspira,* especially the coronated forms, and the peculiar columellae are remarkably alike. The granulated surface of the columella of *bairdi* is also present in immature specimens of *euspira. U. bairdi* differs from *M. euspira* primarily in having a more conical shape with the sutures rather indistinct and not strongly impressed, having weaker spirals on the first whorl, and having the columella slightly different. The similarities of the 2 species lead me to believe that they should be congeneric.

Genus **Calliotropis** Seguenza, 1903

Calliotropis Seguenza, 1903: 462.
Solariellopsis Schepman, 1908: 53 (*non* Gregorio, 1886).
Margarita (partim), Auctt. (*non* Gray, 1847a).
Solariella (partim), Auctt. (*non* S. V. Wood, 1842).

Type-species.—Trochus ottoi Philippi, 1844; by original designation, Seguenza, 1903: 462.

Diagnosis.—Shell small to moderate in size, thin, iridescent, inflated, widely umbilicate, sculptured with spiral rows of sharp tubercles. Radula with rhachidian, 3 subequal laterals and 1 rudimentary lateral, and 12 to 21 rather small marginals.

Remarks.—Calliotropis was erected by Seguenza for the fossil trochid *Trochus ottoi* Philippi (Figs. 5, 6). *C. regalis* (Verrill & Smith) (Figs. 7, 8) has been considered a synonym of *ottoi* since shortly after its description. However, as Rehder & Ladd (1973) have pointed out, the 2 are very closely related but entirely distinct species. The numerous marginal teeth of the radula show it to be in the Margaritinae rather than in the Solariellinae where many of its species have been placed as recently as 1974 (Abbott, 1974). *Calliotropis* recently has been considered a subgenus of *Lischkeia* Fischer, 1879, but the large, rather heavy shell, umbilical callus, and reflected inner lip of the latter seem to be sufficient characters for generic separation.

Subgenus **Solaricida** Dall, 1919

Solaricida Dall, 1919: 361.—Keen, 1960: I262.—McLean, 1971: 331.

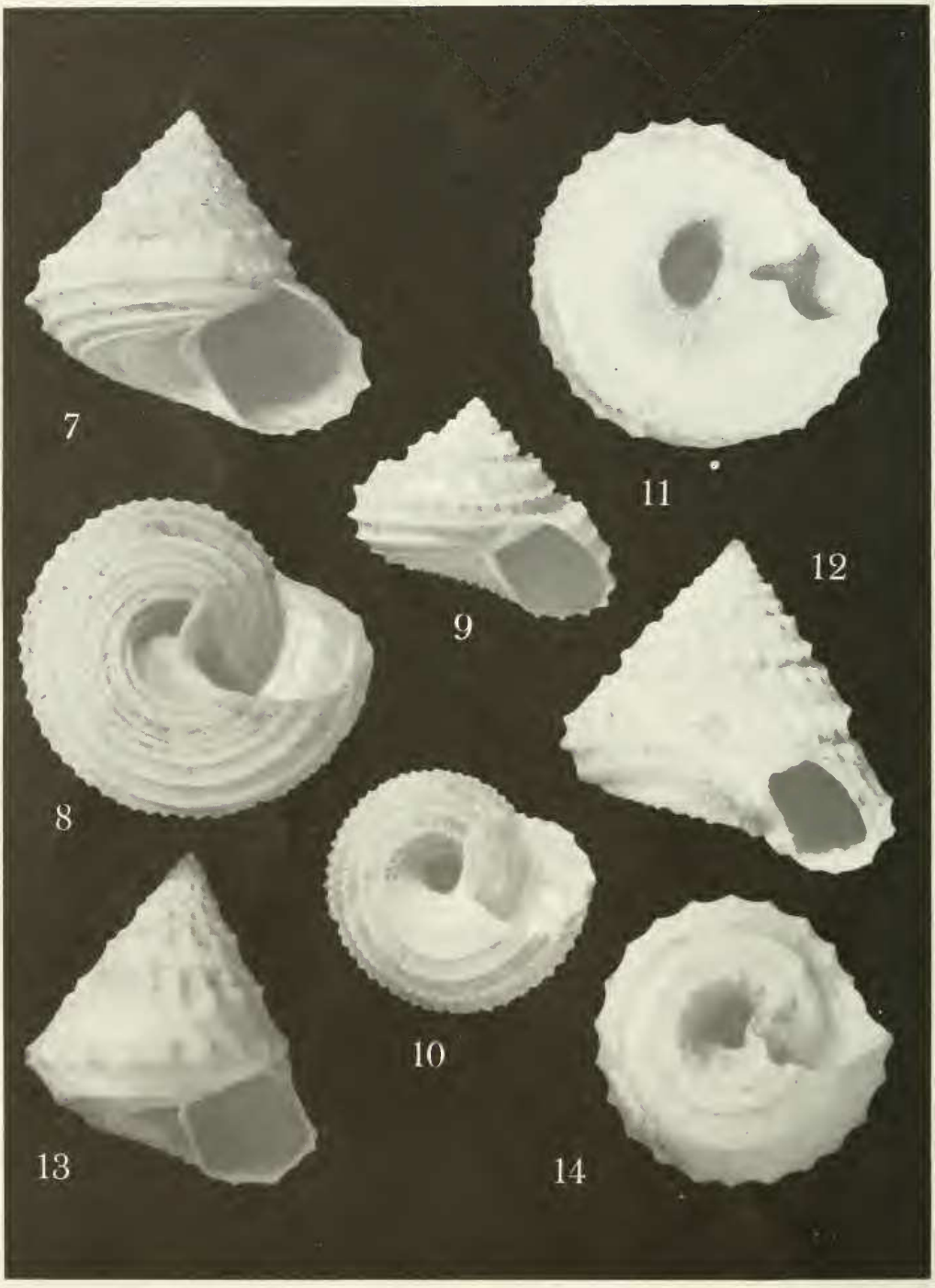
Type-species. — Solariella (Solaricida) hondoensis Dall, 1919; by monotypy, Dall, 1919: 361.

Diagnosis.—Shell generally more inflated than *Calliotropis s. s.,* with a wider and deeper umbilicus.

Calliotropis (Solaricida) aeglees
(Watson, 1879)
Figs. 11,12

Trochus (Margarita) aeglees Watson, 1879: 704; 1886: 81, pl. 5, fig. 10.
Trochus (Margarita) ottoi: Jeffreys, 1883: 98 (*partim*).
Margarita (Solariella) aegleis: Dall, 1889a: 379 (*partim*); 1889b: 164 (*partim*; listed only).—Pilsbry, 1889: 315, pl. 66, figs. 18, 19 (*partim*; description from Watson, 1879; figs. from Watson, 1886).
Solariella (Machaeroplax) aegleis aegleis: Johnson, 1934: 71 (*partim*?; listed only).
Solariella aegleis aegleis: Abbott, 1974: 41 (*partim*; listed only).

Description.—Shell small (attaining a height of about 5 mm), broadly conical, of about 6 whorls, white with an underlying nacreous lustre. Protoconch small, prominent, glassy, of about 1½ whorls. First whorl with strong axial riblets which disappear on later whorls. Sculpture on later whorls of spire consisting of 2 spiral rows of rounded, axially produced tubercles. There is no connection between the tubercles of 1 row and those of the other, but an obscure spiral cord connects the tubercles of each individual row. Upper row very close to the suture line and separated from the second row by a fairly broad, flat area. Body whorl bears a third carina just below the second and forms the whorl periphery. Distance between the lower 2 carinae about half that between the upper 2, giving



FIGS. 7–14. 7–8. *Calliotropis (Calliotropis) regalis* (Verrill & Smith): USNM 44681. 9–10. *Calliotropis vaillanti* Fischer: USNM 94958. 11–12. *Calliotropis (Solaricida) aeglees* (Watson (syntype): CHALLENGER-24, h = 6.9 mm, d = 7.3 mm. 13–14. *Calliotropis (Solaricida) lissocona* (Dall) (holotype): BLAKE-47, h = 5.6 mm, d = 5.2 mm.

the whorl a sloping contour. Base rounded, narrow, with 3 spiral cords. Outer spiral obscurely beaded, the middle 1 smoothish, and the inner set with strong rounded tubercles, forming the umbilical margin. Spaces between the basal cords concave with rather strong radial plications which continue up into the umbilicus. Umbilicus very wide but sharply constricted within, deep. Aperture oblique, rounded, quadrangular; lips thin, inner lip reflected slightly. Columella thin, concave above and below a blunt tooth which is the termination of a spiral ridge extending into the aperture.

Holotype.—None selected. The syntype series is in the British Museum (Natural History), cat. nos. 87.2.9.311-314, and 1 syntype is in the USNM, cat. no. 118787; all are from CHALLENGER sta. 24.

Type-locality.—CHALLENGER sta. 24, 18°38′30″N, 65°05′20″W, off Culebra Island, Virgin Islands, 713 m.

Material examined.—Straits of Florida: G-1008; 1, UMML 30-8044.—G-1096; 1, UMML 30-8036.—Caribbean: J-S sta. 67; 13, USNM 429422.—J-S sta. 93; 2, USNM 429539.—CHALLENGER sta. 24; 1, USNM 118787 (syntype).

Geographic distribution.—Known only from the Straits of Florida near Cay Sal Bank, off the Dry Tortugas, and from off Puerto Rico and the Virgin Islands.

Bathymetric range.—*C. aeglees* occurs in rather deep water, from 350 to 732 m.

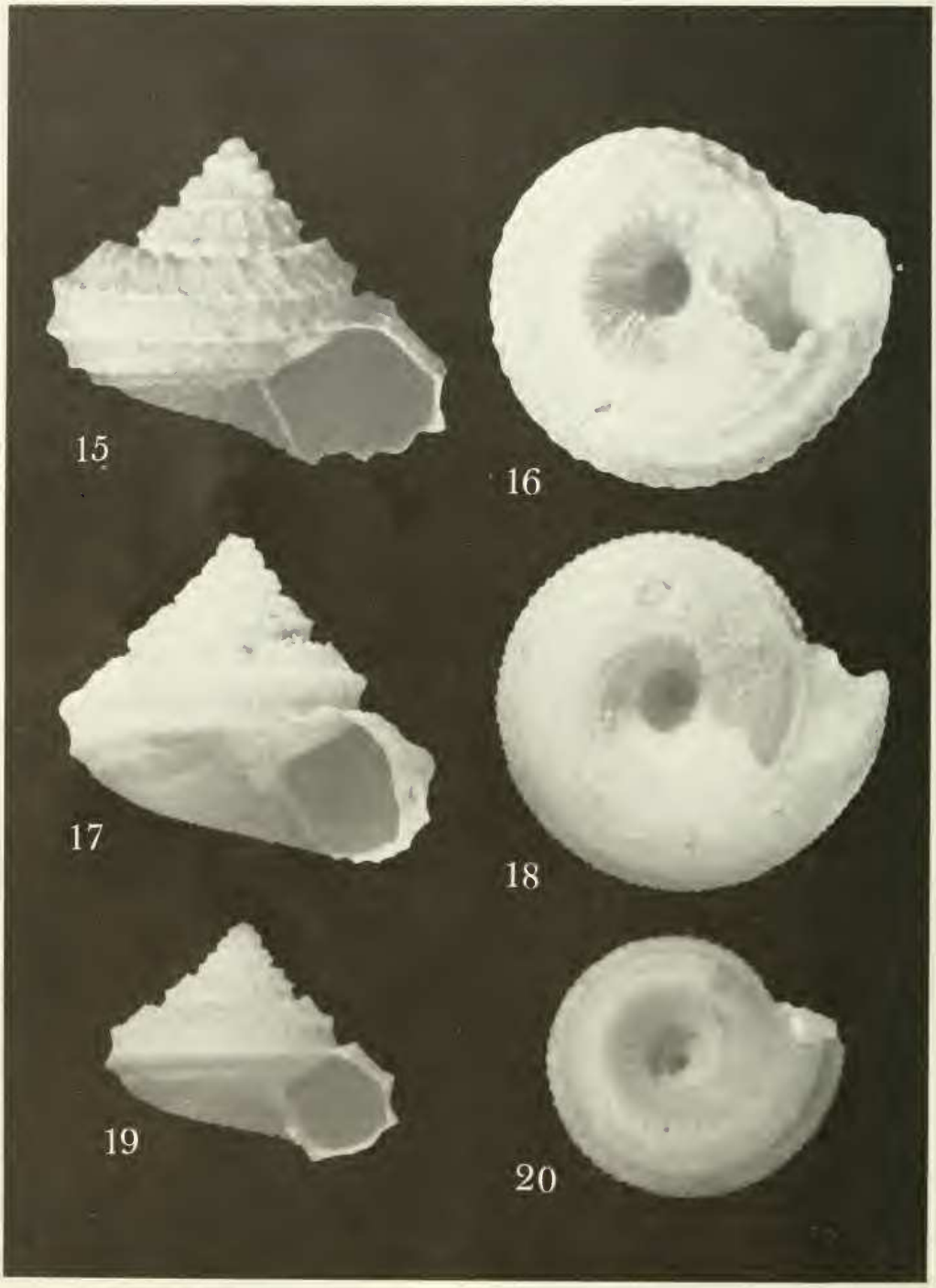
Remarks.—There has been an extraordinary amount of confusion surrounding this species. In 1879, Watson described *C. aeglees, Trochus lima* (=*C. rhina* Watson, 1886), *Echinogurges clavatus* and *E. rhysus* as *Trochus (Margarita)* species. Dall (1881) reported *aeglees* from the BLAKE dredgings and included *Solariella lamellosa* as a synonym. This was a mixed lot consisting primarily of specimens of *S. lamellosa, S. pourtalesi* Clench & Aguayo, and probably some specimens of *Calliotropis calatha* (Dall), *C. rhina,* and *E. clavatus,* all of which he considered merely forms of one another. In 1883, J. G. Jeffreys placed *aeglees* into synonymy with *C. ottoi* (Philippi), a Pliocene fossil from Italy. Watson (1886) disagreed with Dall's opinion (1881) that *S. lamellosa* was synonymous with *aeglees,* and he also expressed doubt that Jeffreys' identification of *aeglees* with *C. regalis* (Verrill & Smith) was correct. Dall, in the meantime, had obtained the Jeffreys collection, and, on the basis of this additional material, modified his earlier views somewhat. He removed *S. lamellosa* and *S. pourtalesi* (as *S. amabilis* Jeffreys) from synonymy with *aeglees,* but added a new variety, *lata* (=*C. calatha* Dall). This variety was introduced as a *nomen nudum,* and an examination of his specimens reveals another mixed lot. Along with *aeglees,* Dall mentioned 2 lots of fossils from the Tertiary of Belgium and 2 from Italy, and a specimen taken by the TALISMAN expedition. There seems to have been a transposition of labels of the fossil lots which Dall was unable to straighten out, and as a result, he was faced with a problem in assigning names to the specimens. Apparently the labels of a lot of *Trochus peregrinus* Libassi (USNM 94960, not 94952) and a lot of *"Solarium" turbinoides* Nyst (=*Solariella maculata* S. V. Wood; USNM 94952, not 94960) were transposed before Dall examined them. He decided that *peregrinus* was the same as his variety *lata.* They are closely related, but definitely not conspecific. He continued to believe, however, that *rhina, clavatus, rhysus,* and his "wide form" *lata* were all varieties of *aeglees.* One factor which probably contributed to Dall's confusion was the rather poor quality of the illustrations of each species in the CHALLENGER report (Watson, 1886). The specimen from the TALISMAN, labeled *"Trochus ottoi"* by Jeffreys, is an Eastern Atlantic species, *Calliotropis vaillanti* (Fischer) (Figs. 9, 10), although later in his discussion of *ottoi,* Dall stated that he had never seen a specimen of this species. All works since Dall (1889) have followed his opinions uncritically, neither noticing that the variety *"lata"* was a *nomen nudum,* nor that this form is the same as *C. calatha* Dall.

C. aeglees differs from *calatha* in having (1) the spire more conical than scalar; (2) the subsutural carina abutting the suture rather than separated from it by a narrow shelf; (3) the mid-whorl carina lower on the whorl; and (4) the tubercles of all 3 carinae more equal in size, less prominent, and more rounded than in *calatha.*

As redefined here, *C. aeglees* has a far more restricted range than previously supposed, and is rather rare, especially when compared to the number of specimens of *calatha* available.

Calliotropis (Solaricida) calatha
(Dall, 1927)
Figs. 15–20, 23–26

Margarita (Solaricida) aegleis var. *lata* Dall, 1889a: 380 (*partim*); 1889b: 164 (listed



FIGS. 15–20. 15–16. *Calliotropis (Solaricida) calatha* (Dall) (syntype): ALBATROSS-2415, h = 4.1 mm, d = 5.0 mm. 17–18. *Calliotropis (Solaricida) calatha* (Dall) ("var. *lata*" Dall): G-1312, h = 4.7 mm, d = 6.3 mm. 19–20. *Calliotropis (Solaricida) calatha* (Dall): G-1008, h = 4.5 mm, d = 5.9 mm.

only).—Johnson, 1934: 71 (listed only). All are *nomina nuda.*

Solariella calatha Dall, 1927a: 128.—Johnson, 1934: 72 (listed only).—Abbott, 1974: 41 (listed only).

Solariella aegleis aegleis: Abbott, 1974: 41 (*partim*; listed only).

Description.—Shell attaining a height of 9 to 10 mm, broadly conical, carinated, spire high or slightly depressed, widely umbilicate, highly sculptured, of about 6 whorls, white with an underlying nacreous lustre. Protoconch small, prominent, glassy, of 1½ whorls. Spire bearing 2 (occasionally 3) carinae set with numerous sharp, axially produced tubercles; another similar carina becomes visible on the body whorl. Tubercles of each carina connected by a fine spiral thread; number of tubercles on lower 2 carinae may vary greatly in a series of specimens, but usually is about 60 on the last whorl. Upper carina separated from the suture by a narrow shelf and bears about 20 to 30 sharp tubercles. Periphery of the whorl may be formed by either or both of the lower 2 carinae. Middle carina lies slightly closer to lower carina than to subsutural carina. Occasional specimens may have another carina intercalated below the subsutural one. Base with 3 to 4 finely beaded cords, the innermost of which is somewhat stronger and more coarsely beaded and defines the umbilical margin. Surface of the whorls between the spiral sculpture may be smooth (except for fine growth lines) to highly corrugated axially. Umbilicus very wide, deep, and strongly constricted within; walls slightly concave, axially rugose, and often with fine spiral cords. Aperture strongly oblique, ovate; lips thin, inner lip slightly reflected over the umbilicus. Columella strongly arched, slightly thickened, usually ending in a strong, blunt tooth, below which the lip is concave, rounding into the basal lip. Periostracum thin, brown.

Holotype.—None selected. Syntype series is in the USNM, cat. no. 108424, 13 specimens from ALBATROSS sta. 2415.

Type-locality.—ALBATROSS sta. 2415, 30°44′N, 79°26′W, 805 m.

Material examined.—ALBATROSS sta. 2415; 13, USNM 108424 (syntypes).—ALBATROSS sta. 2668; 18, USNM 108121.—Straits of Florida: G-1312; 1, UMML 30-8091.—Off Fowey Rocks, Miami, Rush Coll., 850 m; 1, USNM 83034.—G-289; 1, UMML 30-8100.—G-1018; 2, UMML 30-8047.—G-1008; 1, UMML 30-8045.—EOLIS sta. 329 off Sambo Reef, 247 m; 1, USNM 450557.—G-1015; 1, UMML 30-8035.—G-967; 1, UMML 30-8034.—BLAKE sta. 2; 1, USNM 94955.—Yucatan Channel: BLAKE, sta. no. unrecorded, near Cape San Antonio, Cuba, 1170 m; 1, USNM 94954.—Caribbean: P-604; 4, UMML 30-8101.—P-605; 2, UMML 30-8102.—P-607; 2, UMML 30-8103.—Off Cour del Padre, Cuba, 1166 m; 4, USNM 94956.—P-1225; 5, UMML 30-8104.—J-S sta. 67; 4, ex USNM 429422.—J-S sta. 94; 2, USNM 429923.—P-919; 5, UMML 30-8105.—P-929; 2, UMML 30-8106.—P-905; 4, UMML 30-8107.—BLAKE sta. 230; 1, USNM 94957.—P-861; 9, UMML 30-8108.—P-846; 1, UMML 30-8109.—P-754; 2, UMML 30-8110.

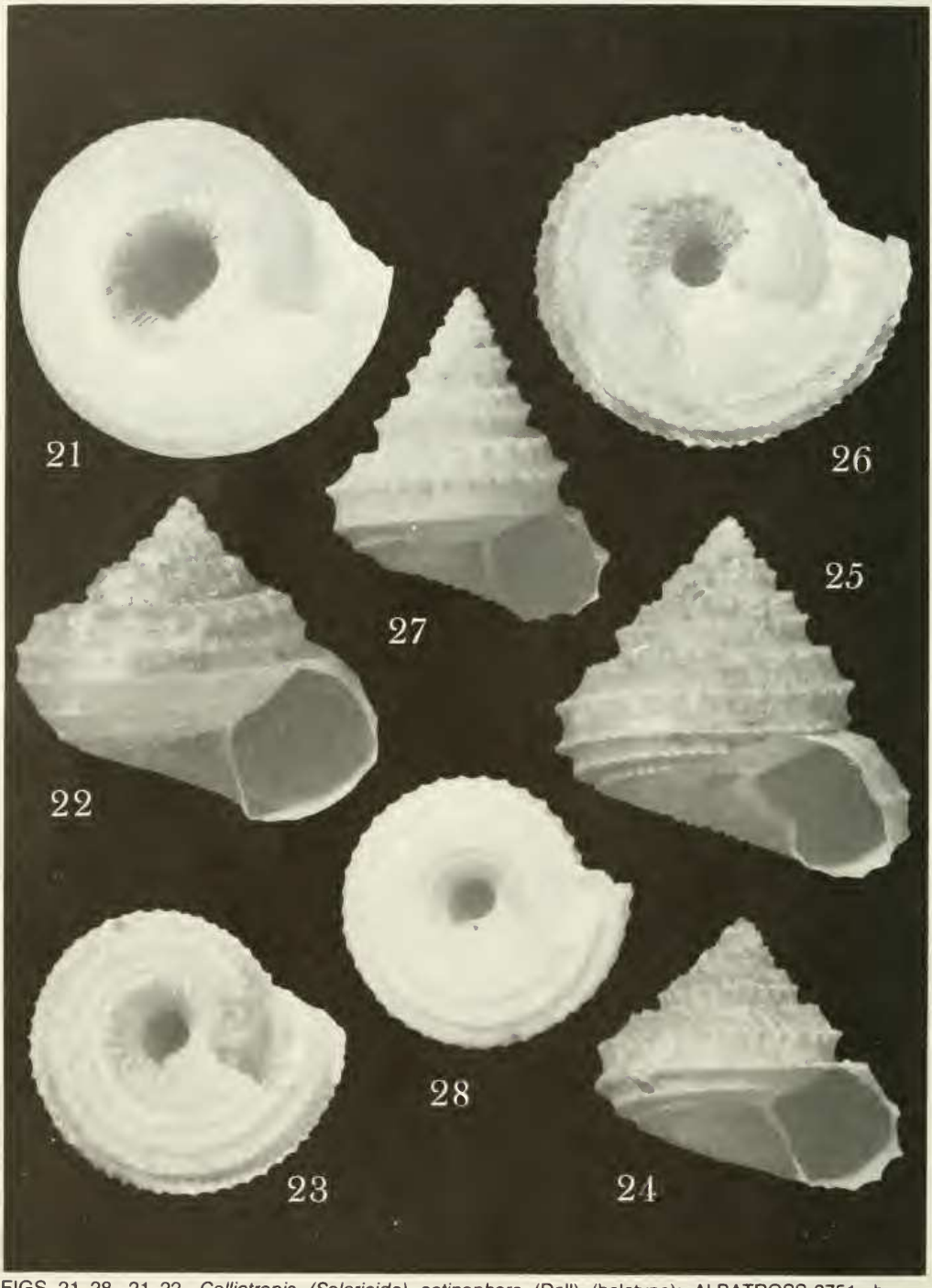
Geographic distribution.—From off Georgia south through the Straits of Florida and the Yucatan Channel, and throughout the Caribbean.

Bathymetric range.—The possible range is 18 to 1574 m, but specimens are generally found in about 500 to 1000 m. The station which records 18 meters as the shallowest depth (P-861) spanned a total depth range of 726 meters (18–744 m); otherwise the species is found almost exclusively in depths exceeding 500 m.

Remarks.—See *Remarks* section under *C. aeglees.* This species has been cited under the name *"Solariella" aegleis lata* since Dall's mention of the name in 1889. This was a *nomen nudum* and has never been validated, so the name cannot stand for the species. However, examination of the specimens of "*lata*" and *C. calatha* (Dall, 1927) in the USNM has revealed that the two are conspecific, and the species therefore takes the later name.

This is an extremely variable species, not only over its whole range, but within individual populations. The elevation of the spire, the distinctness of the axial sculpture, the number of tubercles on the carinae, and the width of the umbilicus are all involved in the variation. As different as any two specimens seem, there appears to be a "connecting link" throughout a long series of specimens. It is at present impossible to separate any of the forms satisfactorily into even subspecies since there is no consistent pattern in the variation either geographically or bathymetrically.

Two specimens are worthy of note. One specimen from G-23 (25°32′N, 79°44′W, 477–238 m, UMML 30-8024) and 1 from P-741 (11°47.8′N, 66°06.8′W, 1052–1067 m,



FIGS. 21–28. 21–22. *Calliotropis (Solaricida) actinophora* (Dall) (holotype): ALBATROSS-2751, h = 7.4 mm, d = 8.4 mm. 23–24. *Calliotropis (Solaricida) calatha* (Dall): P-605, h = 6.75 mm, d = 7.7 mm. 25–26. *Calliotropis (Solaricida) calatha* (Dall): P-846, h = 9.1 mm, d = 9.2 mm; 27–28. *Calliotropis (Solaricida) rhina* (Watson): G-966, h = 7.0 mm, d = 6.0 mm.

UMML 30-6808) are possibly specifically distinct. They have peripheral carinae with extremely closely-set, scalelike tubercles, a rather narrow, vertically-walled umbilicus, and slightly more elevated spire, but because *C. calatha* is so variable and the specimen from off Cour del Padre, Cuba (USNM 94956) approaches this form, I am reluctant to erect a separate taxon for these shells until more material is available for study.

Calliotropis (Solaricida) rhina
(Watson, 1886)
Figs. 27,28

Trochus (Margarita) lima Watson, 1879: 703 (*non* Philippi, 1844).
Trochus (Margarita) rhina Watson, 1886: 80, pl. 5, fig. 1 (*nom. nov.* for *T. (M.) lima* Watson, 1879).
Margarita (Solariella) aegleis var. (?) *rhina*: Dall, 1889a: 380; 1889b: 164 (listed only).—Pilsbry, 1889: 316, pl. 64, figs. 51, 52 (description from Watson, 1879; figs. from Watson, 1886).
Solariella (Machaeroplax) aegleis rhina: Johnson, 1934: 71 (listed only).
Solariella aegleis aegleis: Abbott, 1974: 41 (*partim*; listed only).

Description.—Shell attaining a height of more than 10 mm, conical, spire rather extended, carinated, widely umbilicate, of 6½ to 7 whorls, white with an underlying iridescence. Protoconch smooth, glassy, prominent, of about 1½ whorls. There are 2 carinae on the spire with a third becoming apparent on the body whorl; these are set with many sharp, conical tubercles. Upper carina separated from the suture by a narrow, flat shelf; tubercles are strongest on this carina and are connected by a fine spiral cord. Below the subsutural carina are 2 stronger carinae forming the periphery, the lower of which defines the base. These carinae have about twice as many, finer tubercles as the subsutural carina. Base rounded, with 3 or 4 finely beaded spiral cords, the innermost of which defines the umbilicus. Axial sculpture of strong lamellar ribs on the first postnuclear whorl, but thereafter of only fine growth lines, which may become stronger near the umbilicus and ascend into the umbilicus. Umbilicus rather wide, deep, with convex walls which may bear 1 or 2 fine spiral cords. Aperture slightly oblique, ovate; outer lip thin and angled by the carinae; inner lip thin and slightly reflected; columella smooth, straight, rounding to meet the outer lip. Periostracum rather heavy, brown.

Holotype.—None selected. The syntypes are probably in the British Museum (Natural History). Watson mentioned 1 specimen in particular as "an almost exceptionally fine specimen from Station 78" which probably should be chosen as lectotype.

Type-locality.—CHALLENGER sta. 78, 37°26′N, 25°13′W, off San Miguel, Azores in 1829 m, herein restricted.

Material examined.—ALBATROSS sta. 2384; 1, USNM 93812.—Straits of Florida: G-190; 1, UMML 30-7748.—G-23; 1, UMML 30-8039.—G-368; 1, UMML 30-8027.—G-1106; 1, UMML 30-8096.—G-126; 1, UMML 30-8040.—G-966; 1, UMML 30-8093.—G-439; 1, UMML 30-6971.—BLAKE sta. 2; 2, USNM 94950.—P-605; 6, UMML 30-8111.—P-607; 5, UMML 30-8112.—ALBATROSS sta. 2150; 2, USNM 93855.—P-1255; 4, UMML 30-8113.—P-1256; 3, UMML 30-8114.—P-1261; 6, UMML 30-8115.—CHALLENGER sta. 24; 1, *ex* USNM 118787.—P-988; 3, UMML 30-8116.—P-919; 1, UMML 30-8117.—P-904; 1, UMML 30-8118.—P-861; 3, UMML 30-8119.—P-754; 2, UMML 30-8120.—P-766; 1, UMML 30-8121.

Geographic distribution.—*C. rhina* is an amphi-Atlantic species; it is recorded from off the Azores in the Eastern Atlantic, and the Gulf of Mexico, the Straits of Florida and Caribbean.

Bathymetric range.—As in *C. calatha,* the possible depth range is from only 18 m to over 1800 m. Disregarding the 18 m record (since the station covered a vertical distance of 726 m), the species is usually taken in depths of 500 to 800 m.

Remarks.—*C. rhina* is very closely related to *C. aeglees* (Watson) and *C. calatha* (Dall), but it is much more elevated than either of those two species. It is much less sculptured than *calatha,* the aperture is less oblique, and the columella never has the tooth as in *calatha. C. rhina* is an extremely widespread deep-sea Atlantic species and its characters are remarkably conservative throughout its occurrence, which is in sharp contrast to *calatha.*

Calliotropis (Solaricida) lissocona
(Dall, 1881)
Figs. 13,14

Margarita lissocona Dall, 1881: 41.
Margarita (Solariella) lissocona: Dall, 1889a: 381, pl. 21, figs. 8, 8a; 1889b: 164, pl. 21, figs. 8, 8a (listed only; figs. from 1889a).—Pilsbry, 1889: 322, pl. 48, figs. 23, 24 (description from Dall, 1881; figs. from Dall, 1889a).
Solariella (Machaeroplax) lissocona: Johnson, 1934: 72 (listed only).
Solariella lissocona: Abbott, 1974: 41, fig. 288 (listed only; fig. from Dall, 1889a).

Description.—Shell attaining a height of 6.3 mm, conical, highly iridescent, carinate, umbilicate, of about 6 whorls. Protoconch small, glassy, of a little more than 1 whorl. Just below the suture is a spiral row of small conical beads connected by a fine thread. From this the whorl slopes flatly to the peripheral carina which is formed by a double row of beads similar to those of the subsutural row. The beads of a single row are connected by a fine spiral thread, and the beads of 1 row are semi-fused with their counterparts in the other. Base somewhat convex with 2 strong, sharp, undulate spiral cords in the middle and a strongly beaded cord defining the umbilical margin. Axial sculpture of strong riblets on the first 2 post-nuclear whorls, and thereafter only of fine growth lines. Umbilicus rather wide, deep, strongly constricted within. Aperture subquadrate; outer lip thin, simple; inner lip thin and very slightly reflected; columella slightly oblique, a little arched, ending in an obscure tooth from which the lip curves into the basal lip. Fresh specimens with traces of a brown periostracum.

Holotype.—USNM 214282, from BLAKE sta. 47.

Type-locality.—BLAKE sta. 47, 28°42′N, 80°40′W, off the Mississippi Delta, in 587 m.

Material examined.—Gulf of Mexico: BLAKE sta. 47; 1, USNM 214282 (holotype).—ALBATROSS sta. 2398; 1, USNM 93839.—Straits of Florida: G-967; 1, UMML 30-8122.—Caribbean: P-776; 2, UMML 30-8123.

Geographic distribution.—Known from 2 stations in the northern Gulf of Mexico, 1 in the Straits of Florida near the Marquesas Islands, and 1 in the southern Caribbean off Colombia.

Bathymetric range.—From 408 to 587 m.

Remarks.—This is a beautiful species, apparently most closely related to *C. aeglees* (Watson) from which it differs in being smaller; the peripheral carina is composed of a double row of tubercles more closely apposed than in *aeglees,* and the columella has only a very slight thickening rather than the strong tooth of *C. aeglees. C. lissocona* is a rare, although seemingly rather widespread, species and it will probably turn up in other parts of the Caribbean in depths of about 500 m.

Calliotropis (Solaricida) actinophora
(Dall 1890)
Figs. 21,22

Margarita (Solariella) actinophora Dall, 1890: 353, pl. 12, figs. 8, 11.
Solariella actinophora: Abbott, 1974: 41, fig. 295 (listed only; fig. from Dall, 1890).

Description.—Shell attaining a height of 9 mm, thin, inflated, spire depressed, umbilicate, of 5–6 whorls, highly nacreous when fresh, otherwise white. Protoconch small, glassy, protuberant, of about 1½ whorls. Whorls of the spire with 3 fine, sharp spiral threads; the upper is very fine and very close to the suture; the second is often the strongest and placed just above mid-whorl; the third may be as strong as the second and is just above the succeeding suture. A fourth spiral, hidden by the suture on the spire, forms the periphery of the last whorl. Spiral sculpture is crossed at regular intervals by axial ribs which are of the same character as the spirals. Axials are continuous on the first 3 whorls, forming a reticulate pattern with the spirals; otherwise, the axials are restricted to sharp, close-set plications radiating a short distance from the suture and likewise from the umbilicus. The beading of the upper 2 spirals is coarsest, with the beading becoming much finer on the lower spirals. Base tumid, usually with 3 rather weak, beaded spiral cords between the periphery and a strongly tubercled inner cord which bounds the umbilicus. Umbilicus wide, deep, walls nearly vertical with axial corrugations. Aperture rounded; outer lip thin, simple; inner lip thin, very slightly reflected; columella straight, thin, with a weak to strong tooth at the middle in mature specimens. Periostracum thin, olive-brown.

Holotype.—USNM 96468, from ALBATROSS sta. 2751.

Type-locality.—ALBATROSS sta. 2751, 16°54′N, 63°12′W, south of St. Kitts, Lesser Antilles, in 1257 m.

Material examined.—Straits of Florida: G-824; 1, UMML 30-7701.—G-1111; 1, UMML 30-8037.—G-1112; 2, UMML 30-8038.—G-129; 1, UMML 30-8026.—G-366; 1, UMML 30-8124.—G-375; 1, UMML 30-8029.—G-374; 3, UMML 30-8028.—G-128; 9, UMML 30-8125.—G-965; 6, UMML 30-7761.—G-964; 3, UMML 30-7743; 7, UMML 30-8033.—G-449; 2, UMML 30-6976.—G-448; 2, UMML 30-8126.—G-963; 10, UMML 30-7694.—G-960; 5, UMML 30-8032.—G-959; 1, UMML 30-8031.

Geographic distribution.—The Gulf of Mexico, the Bahamas and the Straits of Florida, south through the Antillean arc, and South America from Tobago to the Rio de la Plata, Argentina.

Bathymetric range.—This species has a possible depth range of 21 to 1863 m, but is generally rather rare in depths less than 1000 m, and rather common between 1000 and 1500 m.

Remarks.—*C. actinophora* has been rather rare in most collections, and has been overlooked in the literature to a great extent. Since its description in 1890, it has been cited only in the semi-technical book *American Seashells* (Abbott, 1974). However, the various ships from RSMAS have taken this species throughout the Caribbean area. It is closely related to *C. infundibulum* (Watson, 1879), a much larger, more elevated species which is also found in the Western Atlantic. *C. actinophora* was taken by the ALBATROSS at station 2764 off the Rio de la Plata in 11½ fathoms (21 m). I am very reluctant to accept the depth here since *actinophora* is rarely taken in depths much shallower than 1000 m, and other species collected at this station occur normally at great depths themselves (e.g., *Seguenzia trispinosa* Watson, 1879).

Genus **Lischkeia** Fischer, 1879

Lischkeia Fischer, 1879: 419.
Margarita (partim): Auctt. (*non* Leach, 1814).
Calliostoma (partim): Pilsbry, 1889: 332.

Type-species.—*Trochus moniliferus* Lamarck, 1816; by original designation, Fischer, 1879: 419.

Diagnosis.—Shell large, elevated trochoid, sculptured by nodulous spiral ribs, umbilicus partly or wholly covered by a thin callus, columella arched and smooth, base flattened to slightly convex.

Subgenus **Turcicula** Dall, 1881

Turcicula Dall, 1881: 42; 1889a: 376; 1889b: 162; 1908: 348; 1909: 98.—Fischer, 1885: 827.—Pilsbry, 1889: 330.—Cossmann, 1918: 254, 263.—Taki & Otuka, 1942: 93.—Rehder, 1955: 222.—Abbott, 1974: 39.

Type-species.—*Margarita (Turcicula) imperialis* Dall, 1881; by monotypy, Dall, 1881: 42.

Diagnosis.—Shell rather thin, sutures deep, sculpture of spiral rows of nodules and axial vermiculate lamellar growth ridges, outer lip reflexed at maturity, umbilicus covered.

Remarks.—This genus is represented by a single species from the Caribbean. The placement of *Turcicula* has been a matter of conjecture since it was first proposed, and will remain so until a specimen with soft parts is available for study. However, in view of the obvious similarities of *Lischkeia monilifera* and *Turcicula imperialis,* I prefer to retain *Turcicula* as a subgenus of *Lischkeia.*

Lischkeia (Turcicula) imperialis (Dall, 1881)
Figs. 29,30

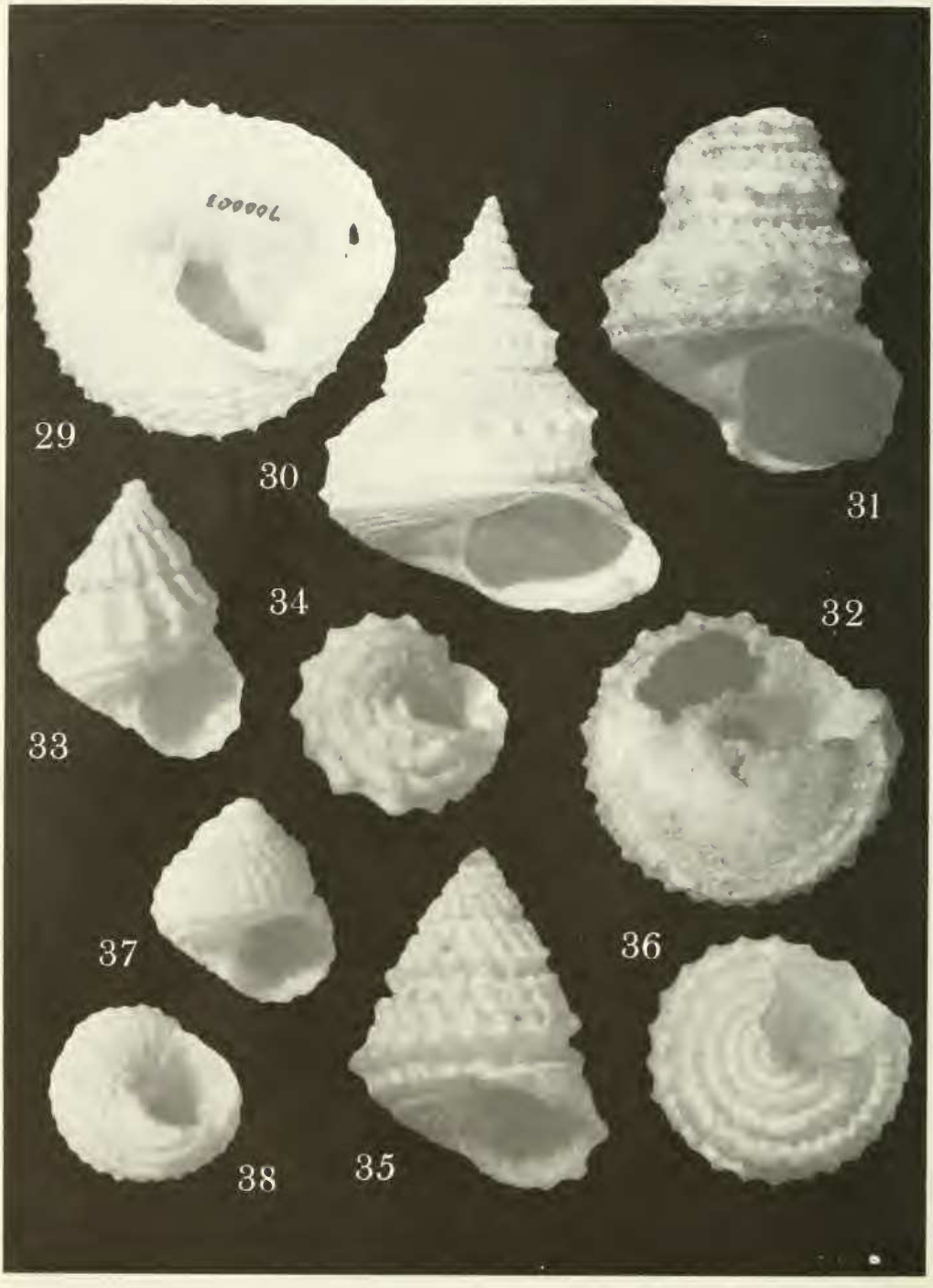
Margarita (Turcicula) imperialis Dall, 1881: 42; 1889a: 376, pl. 22, figs. 1, 1a; 1889b: 162, pl. 22, figs. 1, 1a (listed only; figs. from 1889a).—Pilsbry, 1889: 330, pl. 49, figs. 29, 30 (description from Dall, 1881; figs. from Dall, 1889a).
Turcicula imperialis: Johnson, 1934: 70 (listed only.)—Rehder, 1955: 223, pl. 12, figs. 1–9.—Keen, 1960: I256, figs. 163 (12a,b).
Lischkeia deichmannae Bayer, 1971: 121, fig. 5.
Lischkeia (Turcicula) imperialis: Abbott, 1974: 39, fig. 262.
Calliostoma (Turcicula) imperialis: Humphrey, 1975: 60, pl. 5, fig. 12.

Description.—See Rehder, 1955; Bayer, 1971.

Holotype.—MCZ 7575, from off Cuba, 366 m.

Material examined.—ALBATROSS sta. 2349; 1, USNM 94968.—G-897; 1, UMML 30-7727.—P-889; 1, USNM 700003 (holotype of *L. deichmannae*).

Geographic distribution.—From the southern Straits of Florida off Cuba, Arrowsmith Bank off Yucatan, south and east to the Lesser Antilles.



FIGS. 29–38. 29–30. *Lischkeia (Turcicula) imperialis* (Dall) (holotype of *L. deichmannae* Bayer): P-889, h = 55.0 mm, d = 44.5 mm. 31–32. *Lischkeia (Turcicula) imperialis* (Dall): ALBATROSS-2349, h = 15.0 mm, d = 12.0 mm (immature specimen with spire and body whorl broken). 33–34. *Mirachelus clinocnemus* Quinn, n. sp.: SUI-18, h = 3.4 mm, d = 2.6 mm. 35–36. *Mirachelus corbis* (Dall): G-56, h = 4.6 mm, d = 3.7 mm. 37–38. *Euchelus guttarosea* Dall: EOLIS-315, h = 2.5 mm, d = 2.4 mm.

Bathymetric range.—Prior to 1975 this species was known from depths of 55–91 to 403 m indicating a relatively deep habitat. Humphrey (1975) reported a specimen taken on a beach on Barbados, so perhaps the species inhabits depths considerably shallower than previously believed.

Remarks.—This species was known only from 2 broken and immature specimens until Rehder (1955) reported a mature specimen taken near St. Vincent, Lesser Antilles. In the same paper he redescribed *imperialis* in light of the new material, reviewed the history and supposed relationships of *Turcicula,* and concluded that it was of generic standing. Bayer (1971) based his *L. deichmannae* on an almost perfect specimen of *imperialis* and noted its striking similarity to the type species of *Lischkeia, L. monilifera.* It is this similarity which prompts me to follow Wenz (1938) in placing *Turcicula* as a subgenus of *Lischkeia.*

Genus **Euchelus** Philippi, 1847

Euchelus Philippi, 1847a: 20.
Monodonta (partim): Auctt.
Trochus (partim): Auctt.

Type-species.—Trochus quadricarinatus Holten, 1802; by subsequent designation, Herrmannsen, 1847: 430.

Diagnosis.—Shell solid, turbinate, with spiral beaded cords; umbilicus open or closed; aperture ovate, outer lip thickened, lirate within; columella thickened, with a tooth at its base.

Euchelus guttarosea Dall, 1889
Figs. 37,38

Euchelus guttarosea Dall, 1889a: 382, pl. 33, fig. 7; 1889b: 164, pl. 33, fig. 7 (listed only; fig. from 1889a).—Johnson, 1934: 73 (listed only).—Abbott, 1974: 38, fig. 258.
Euchelus (Euchelus) guttarosea: Pilsbry, 1889: 443, pl. 51, fig. 21 (description and fig. from Dall, 1889a).

Description.—Shell small (attaining a height of about 6 mm), solid, imperforate, with about 5 rounded, highly sculptured whorls. Protoconch depressed, small, glassy, of about 1½ whorls. Spiral sculpture consists of 3 strong cords on the spire with a 4th appearing on the body whorl and forming the whorl periphery; smaller, intercalary spirals are usually present; base with 4 to 7 slightly nodulous cords. Axial sculpture on the first postnuclear whorl of fine, sharp retractive riblets, becoming stronger on the later whorls; these form strong nodules on the spirals, and with the spirals form a strong reticulate pattern on the whorls. Aperture ovate, thickened within, with 7 to 8 strong lirations ending in strong denticles; columella short, straight, thickened, with a strong tooth near its base. Color white, often with discrete spots of red on the major spirals.

Holotype.—USNM 54774, from Nassau, New Providence Island, Bahamas.

Material examined.—Bahamas: Nassau, New Providence Is.,; 1, USNM 54774 (holotype).—Straits of Florida: EOLIS sta. 329, off Sambo Reef, 247 m; 1, *ex* USNM 438325; 12, USNM 450556.—EOLIS sta. 330, off Sambo Reef, 220 m; 1, USNM 450559.—EOLIS sta. 333, off Key West, 201 m; 1, USNM 450534.—BLAKE sta. no. unrecorded, off Havana, Cuba, 823 m; 1, USNM 95047.

Geographic distribution.—The Bahamas, southeast Florida, and south through the Antilles to Barbados.

Bathymetric range.—This species, like all the others of the genus, is primarily a shallow water species, occurring below the 100 m level only as dead shells. Deeper records are usually in the vicinity of a sharp drop-off, and shells are washed down the slope to as deep as 823 m.

Remarks.—The shells from deep water are all dead and few exhibit the rose-colored patches often seen in the shallow water forms. Whether this is due to wear of the shell is hard to say, but many of the fresher specimens from deeper water are pure white, indicating that perhaps there is a population in deeper water which never develops the coloration of some shallow water forms.

Genus **Mirachelus** Woodring, 1928

Mirachelus Woodring, 1928: 434.—McLean, 1970: 118.—McLean, 1971: 311.

Type-species.—Calliostoma corbis Dall, 1889; by original designation, Woodring, 1928: 434.

Diagnosis.—"Shell small, conical, imperforate, inner layer nacreous. Aperture subquadrangular. Outer lip, as viewed from above, slanting backward from suture. Basal lip almost straight. Outer and basal lips lirate within aperture. Columella vertical, bearing a tooth-like inflation near base. Parietal wall covered with thin wash of callus. Sculpture reticulate." (Woodring, 1928).

Remarks.—This genus has been considered by most recent workers to be a subgenus of either *Solariella* S. V. Wood, 1842, or *Euchelus* Philippi, 1847. McLean (1970) described a species from the Eastern Pacific whose dentition showed a close relationship with *Euchelus,* but the differences in shell sculpture and radular details indicate that *Mirachelus* should be separated at the generic level. While examining material of *M. corbis* in the collections of the USNM, I discovered a form which seems to be specifically distinct from *corbis,* and it is herein described.

Geographic distribution.—Western Atlantic: the southern Straits of Florida, the Gulf of Mexico, and south to the Lesser Antilles.—Eastern Pacific: the Galapagos Islands and Cocos Island.

Bathymetric range.—Known from 165 to 1426 m.

Mirachelus corbis (Dall, 1889)
Figs. 35,36

Calliostoma tiara: Dall, 1881: 45 (*partim*).
Calliostoma corbis Dall, 1889a: 365, pl. 33, fig. 1; 1889b: 162, pl. 33, fig. 1 (listed only; fig. from 1889a).—Pilsbry, 1889: 381, pl. 48, fig. 7 (description and fig. from Dall, 1889a).—Johnson, 1934: 69 (listed only).
Mirachelus corbis: Woodring, 1928: 434.
Solariella (Mirachelus) corbis: Clench & Turner, 1960: 79 (listed only).
Euchelus (Mirachelus) corbis: Keen, 1960: 1250 (listed only).—Abbott, 1974: 39, fig. 259 (listed only; fig. from Dall, 1889a).

Description.—Shell small (attaining a height of about 5 mm), solid, compactly conical, carinate, highly sculptured, imperforate, of about 6 whorls. Protoconch small, glassy, of 1 whorl. Spiral sculpture of a very strong peripheral cord and a slightly weaker subsutural cord, usually with 1 or 2 similar cords intercalated between; another cord, on which the suture is formed, lies just under the periphery and defines the base; base with 5 (rarely 4) cords which are slightly excavated along their outer edges. First 1 or 2 whorls with thin axial ribs; axial sculpture on remaining whorls of strong, oblique ribs, which nodulate the spirals and form deep, squarish pits between the spirals; axials not as strong on the base, but nodulate the basal spirals. Base convex, terraced by the spiral sculpture, imperforate. Aperture rounded, thickened within, strongly lirate; lips thin, outer lip crenulated; columella short, thickened, with a blunt tooth in the middle.

Holotype.—MCZ 7562, from off Havana, Cuba.

Type-locality.—Off Havana, Cuba, in 823 m (BLAKE sta. 51?).

Material examined.—Straits of Florida: G-56; 1, UMML 30-5519.—EOLIS sta. 329, off Sambo Reef, 247 m; 12, USNM 450566.—EOLIS sta. 330, off Sambo Reef, 220 m; 1, USNM 450559.—EOLIS sta. 332, off Sambo Reef, 210 m; 1, USNM 450560.—EOLIS sta. 333, off Key West, 201 m; 1, USNM 450534.—EOLIS sta. 325, off Sand Key, 174 m; 1, USNM 450530.—EOLIS sta. 319, off Western Dry Rocks, 165 m; 1, USNM 450567.—BLAKE sta. ?, off Havana, Cuba, 823 m; 1, MCZ 7562 (photograph of holotype, courtesy of Barbara Steger).—BLAKE sta. 20; 2, USNM 95023.—Caribbean: ALBATROSS sta. 2135; 1, USNM 93907.—SUI sta. 116, off English Harbor, Antigua, "deep"; 4, USNM 500229.—SUI sta., off Barbados, "deep"; 1, USNM 500222.

Geographic distribution.—Straits of Florida from off Miami to Key West, the Gulf of Mexico, and south to Barbados.

Bathymetric range.—From 165 to 1426 m.

Remarks.—This compact little species seems to be widely distributed throughout the Caribbean and appears to be rather rare. It is a larger and more finely sculptured species than *M. clinocnemus* n. sp., and occurs in deeper water. It is most commonly taken in depths of 200 to 300 m while *clinocnemus* is rarely found in more than 150 m.

Mirachelus clinocnemus Quinn, n. sp.
Figs. 33,34

Description.—Shell small (attaining a height of about 4.5 mm), solid, conical, of about 6 whorls. Protoconch small, polished, white, of 1½ whorls. Spiral sculpture of 2 very strong, subequal cords, forming a square periphery; shell constricts sharply beneath the periphery to the base which has 4 (rarely 3 or 5) rather strong cords. Axial sculpture of strong, retractive, widely spaced ribs; each rib begins as a nodule at the suture and continues across the peripheral cords, forming strong nodules; axials weak on the base, but bead the spirals. Suture indistinct, obscured by the subsutural nodules. Base convex, often with an umbilical chink. Aperture subcircular, thickened within by a layer of nacre; lips thin, outer lips crenulated by the external

sculpture; columella short, straight, thickened, with an obscure tooth in the middle, often completely closing the umbilical chink. Operculum thin, brown, corneous, multispiral. Radular formula ~15.4.1.4.~15. Rhachidian with a broad base and bearing a strong central cusp with 3 sharp lateral cusps on each side; laterals all similar, each with a strong central cusp and 6 lateral cusps; marginals in two series: inner series of 5 very strong, large, sickle-shaped teeth, inner 2 dentate on both edges, outer 3 dentate only on outer side, all overhanging the central part of radula; outer series of about 10 weaker teeth directed outward, outer edges of teeth may be minutely dentate. Radula less than 0.2 mm total width and 1.5–2.0 mm long.

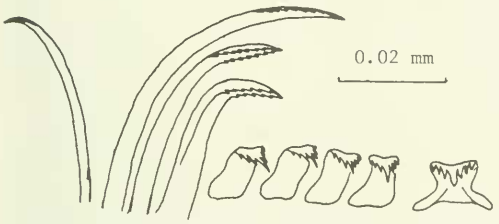


FIG. 89. Partial radular row showing rhachidian, laterals, first three marginals and one marginal from the outer series.

Holotype.—USNM 500731, from off Pelican Island, Barbados.

Type-locality.—Off Pelican Island, Barbados, 146 m (taken by the State University of Iowa Expedition of 1918, sta. 13).

Paratypes.—29 specimens, USNM 711106, with same data as holotype.

Material examined.—EOLIS stations in the Straits of Florida: 157, off Miami Bell Buoy, 40 m; 1, USNM 450514.—Off Fowey Light: 76, 73 m; 1, USNM 450489.—78, 55 m; 2, USNM 450476.—79, 64 m; 3, USNM 450487.—90, 80 m; 1, USNM 450478.—148, 70 m; 1, USNM 450486.—150, 64 m; 3, USNM 450483.—329, off Sambo Reef, 247 m; 4, USNM 438224.—101, off Sand Key, 70 m; 1, USNM 450528.—321, off Western Dry Rocks, 119 m; 1, USNM 450569.—BLAKE sta. 36; 2, USNM 126796.—Antigua: SUI sta. 115, off English Harbour, 220 m; 4, USNM 500744.—Barbados: SUI sta. 3, off Pelican Is., 137–146 m; 54, USNM 500723.—SUI sta. 13, off Pelican Is., 146 m; 30, USNM 500731 & 711106 (1 holotype and 29 paratypes).—SUI sta. 18, off Pelican Is., 73 m; 6, USNM 500726.—SUI sta. 21, off St. Matthais Church, 110 m; 4, USNM 500740.—SUI sta. 25, off Pelican Is., 146 m; 2, USNM 500727.—SUI sta. 26, off Pelican Is., 137 m; 29, USNM 500728.—SUI sta. 27, off Pelican Is., 146–165 m; 8, USNM 500729.—SUI sta. 29, off Lazaretto, 165–183 m; 2, USNM 500732.—SUI sta. 31, off Lazaretto, 146–165 m; 2, USNM 500734.—SUI sta. 44, off Pelican Is., 165–183 m; 7, USNM 500725.—SUI sta. 47, off Pelican Is., 46–132 m; 8, USNM 500730.—SUI sta. 48, off Lazaretto, 172 m; 1, USNM 500733.—SUI sta. 51, off Pelican Is., 60 m; 7, USNM 500724.—SUI sta. 54, off Cable Station, 60 m; 2, USNM 500735.—SUI sta. 67, off Telegraph Station, 91–110 m; 4, USNM 500736.—SUI sta. 78, off Payne's Bay Church, 64–137 m; 4, USNM 500739.—SUI sta. 79, off Telegraph Station, 55–128 m; 8, USNM 500737.—SUI sta. 80, off Telegraph Station, 73–137 m; 8, USNM 500738.—SUI sta., number unrecorded, 146 m; 12, USNM 500743.—SUI sta., number unrecorded, 146 m; 3, USNM 500742.—SUI sta., position and depth unrecorded; 1, USNM 500741.—Brazil off Chui, Rio Grande do Sul, 166 m, 17 Jan. 1972; 1, Museu Oceanográfico do Rio Grande No. 17. 318.

Geographic distribution.—From off Miami, south and west along the Florida Keys to off Key West, and the Lesser Antilles to Barbados; Rio Grande do Sul, Brazil.

Bathymetric range.—Known from 46 to 247 m. This species is concentrated in depths of less than 150 m and is only occasionally taken in greater depths. It probably does not form a part of the molluscan fauna in the Straits below 150 m.

Remarks.—This is the 3rd known species in the genus *Mirachelus*, and the second reported from the Western Atlantic. Specimens of this species have been in the collections of the USNM for many years as *M. corbis* (one lot was labeled by Dall as *corbis*). *M. clinocnemus* can easily be distinguished from *corbis* by the square periphery formed by two subequal spiral cords, not one as in *corbis*, the absence of spiral cords above the peripheral ones, 4 basal cords (5 in *corbis*), and generally smaller size. *M. clinocnemus* is generally a small, compact species, but there are forms which have the spire somewhat extended. The umbilical chink varies from open to completely covered by the columella.

The radula of *M. clinocnemus* is similar to that illustrated by McLean (1970) for *M. galapagensis* but has 4 lateral teeth and differently shaped and stronger inner marginals. The radula of *M. corbis* is unknown.

Genus **Echinogurges** Quinn, gen. nov.

Margarita (partim), Auctt. (*non* Leach, 1814).
Solariella (partim), Auctt. (*non* S. V. Wood, 1842).
Calliotropis (partim), Auctt. (*non* Seguenza, 1903).

Type-species.—*Trochus (Margarita) clavatus* Watson, 1879: 705; herein designated.

Gender.—Masculine.

Diagnosis.—Shell small (about 5 mm), trochoid, acutely conical with an extended spire, base rounded, umbilicate; shell nacreous under an external chalky layer, sculptured by spiral rows of tubercles and/or axial riblets.

Remarks.—This genus seems to be rather well-defined, although apparently closely related to *Calliotropis*. At least 1 species (*E. clavatus*) has been considered a juvenile of *C. aeglees* (Watson). Shells of *Echinogurges* can be distinguished from *Calliotropis* by their much smaller size, the base rounding smoothly into the umbilicus without an umbilical keel, and their much more acutely conical shape. To my knowledge, no living specimens of this genus have been obtained, so radular characters are, as yet, unavailable to aid in placing it. Whatever its relationships, the genus seems distinct enough to warrant generic separation.

Geographic distribution.—Amphi-Atlantic, found in the Eastern Atlantic off Portugal, and in the Western Atlantic off Georgia, the Straits of Florida and the Lesser Antilles. It probably occurs throughout the Caribbean.

Bathymetric range.—538 to 1723 m.

Echinogurges clavatus (Watson, 1879)
Figs. 43,44

Trochus (Margarita) clavatus Watson, 1879: 705; 1886: 82, pl. 5, fig. 8.
Margarita (Solariella) aegleis var. (?) *clavata*: Dall, 1889a: 380; 1889b: 164 (listed only).—Pilsbry, 1889: 318, pl. 66, figs. 98, 99 (description from Watson, 1879; figs. from Watson, 1886).—Johnson, 1934: 71 (listed only).
Margarita (Solariella) clavata: Dall, 1890: 352.
Solariella aegleis aegleis: Abbott, 1974: 41 (*partim*).

Description.—Shell small, attaining a height of 6 mm, conical, with an extended spire, umbilicate, of about 6½ whorls, highly nacreous when fresh. Protoconch small, glassy, prominent, of about 1½ whorls. There are 3 sharp spiral cords on the spire and a fourth appearing on the body whorl; each cord is set with sharp, axially produced tubercles. The upper spiral is just below the suture, the second at about mid-whorl, and the third about mid-way between the second and fourth, on which the suture forms; the second and third are at the periphery of the whorl. Axial sculpture of fine, sharp riblets whose intersections with the spirals produce the nodulations. Base rounding smoothly into the umbilicus with 5 or 6 beaded spiral cords. Umbilicus deep and constricted within to a narrow pore. Aperture almost circular; lips thin; inner lip slightly reflected; columella arched and rounding smoothly into the outer lip.

Syntypes.—Syntypes are in the British Museum (Natural History).

Type-locality.—Watson's original description included 8 specimens from CHALLENGER sta. 24 and 120, but he was uncertain that the 2 from sta. 120 were the same species. Until the type-series can be examined a final decision cannot be made as to the type-locality, but I would expect that it should be CHALLENGER sta. 24, 18°38′30″N, 64°05′30″W, off Culebra Island, Virgin Islands, 713 m.

Material examined.—Bahamas: CI-356; 4, UMML 30-8130.—Straits of Florida: G-23; 3, UMML 30-8078.—G-965; 1, UMML 30-8043.—BLAKE sta. 2; 1, USNM 94951.—ALBATROSS sta. 2751; 4, USNM 95398; 3, USNM 330740.—ALBATROSS sta. 2754; 1, USNM 96877.

Geographic distribution.—The Straits of Florida, the Bahamas, and the Lesser Antilles. *E. clavatus* probably occurs throughout the Antillean arc.

Bathymetric range.—Taken in depths of about 1400 to 1600 m throughout its range.

Remarks.—*E. clavatus* has been long regarded as either a form or a young specimen of *Calliotropis aeglees* (Watson), *C. calatha* (Dall), or *C. rhina* (Watson). It differs from these species in being much smaller and more elevated, in having the base round smoothly into the umbilicus, and in having a prickly aspect to the sculpture. *E. clavatus* seems to be closest to *E. anoxius* (Dall) and *E. rhysus* (Watson). *E. clavatus* can easily be separated from *anoxius* and *rhysus* by having 2 carinae at the periphery rather than one. It is much more highly sculptured than *E. rhysus*, some specimens approaching the sculpture of *anoxius*, but not as coarse as in that species.

Echinogurges anoxius (Dall, 1927)
Figs. 41,42

Solariella anoxia Dall, 1927a: 129.—Abbott, 1974: 41 (listed only).
Solariella (Machaeroplax) anoxia: Johnson, 1934: 72 (listed only).

Description.—Shell small (attaining a height of about 4 mm), acutely conical, with an extended spire, obscurely carinate, highly sculptured, umbilicate, of abut 5½ whorls. Protoconch small, glassy, prominent, of about 1½ whorls. There are 3 major angulations (1 hidden by the suture on the spire) which are almost too obscure to be termed carinae. One lies just below the suture, another is at mid-whorl, and the third, on which the suture is formed, defines the base. Fine spiral cords may or may not be present in the intercarinal spaces. Axial sculpture of strong, close-set ribs which are somewhat oblique above the periphery, from which they descend vertically across the base and into the umbilicus. Intersections of the axial and spiral sculpture result in sharp conical tubercles. Base convex with 3 to 5 spiral cords, rounding into the umbilicus. Umbilicus constricting within to a narrow central pore. Aperture rounded, almost circular; lips thin; columella arched, thin, rounding smoothly into the outer lip.

Syntypes.—USNM 108142, from ALBATROSS sta. 2668.

Type-locality.—ALBATROSS sta. 2668; 30°58′30″N, 79°38′30″W, in 538 m.

Material examined.—ALBATROSS sta. 2668; 9, USNM 108142 (syntypes).—ALBATROSS sta. 2415; 1, USNM 108420; 4, USNM 108421.—Straits of Florida: G-23; 1, UMML 30-8097.

Geographic distribution.—Known only from 2 stations off southern Georgia and 1 off Miami, Florida.

Bathymetric range.—From 538 to 805 m.

Remarks.—This species looks very much like *E. clavatus* (Watson) but is more strongly sculptured and has only a single peripheral carina rather than a double one, and is much smaller. The spiral sculpture varies in that the fine cords between the carinae may or may not be present. The forms with no intermediate spirals approach the appearance of *E. rhysus* (Watson), but the strong axial sculpture is still present, while it is almost totally lacking in *rhysus.*

Echinogurges rhysus (Watson, 1879)
Figs. 39,40

Trochus (Margarita) rhysus Watson, 1879: 706; 1886: 83, pl. 5, fig. 4.—Dall, 1889a: 380 (name only).
Margarita (Solariella) rhysus: Pilsbry, 1889: 324, pl. 66, figs. 9, 10 (description from Watson, 1879; figs. from Watson, 1886).
Non Solariella rhyssa Dall, 1919: 360.

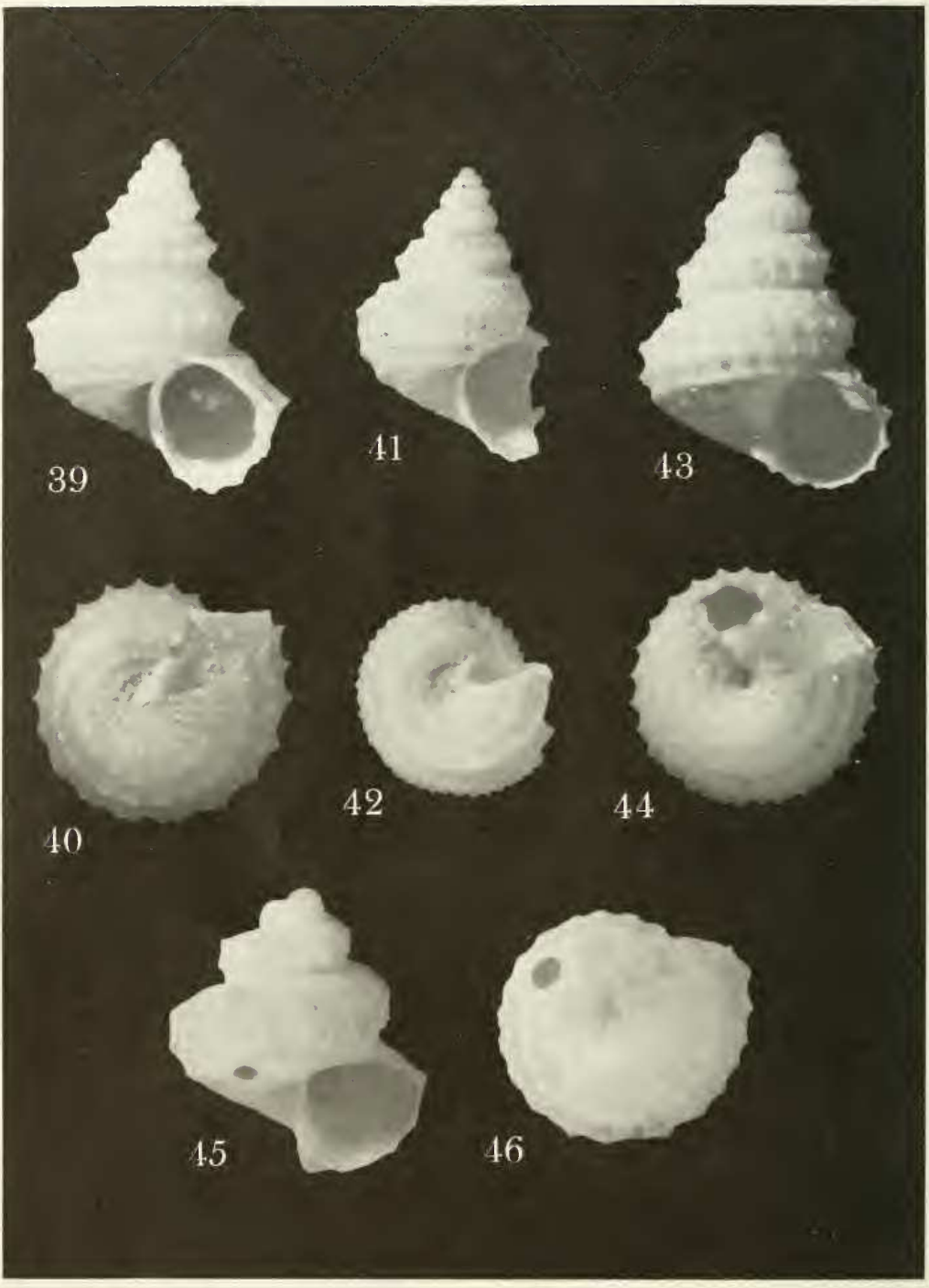
Description.—Shell small (attaining a height of 4.6 mm), conical, with an extended spire, carinate, umbilicate, of about 5½ whorls, nacreous when fresh. Protoconch small, prominent, glassy, of about 1½ whorls. Spiral sculpture of 3 carinae set with sharp, axially produced tubercles; only 2 of the carinae are visible on the spire. The upper carina is just beneath the suture, the second is at mid-whorl and forms the whorl periphery, and the third, on which the suture is formed, defines the base. Base with 4 smooth to finely beaded cords. Axial sculpture of sharp riblets on the first 2 whorls, becoming obsolete on the following whorls where they are indicated by the tubercles on the spiral sculpture. Base convex under the sculpture, rounding into the umbilicus, which constricts within to a narrow central pore. Aperture subcircular; lips thin; inner lip slightly reflected; columella concave, thin, rounding smoothly into the outer lip.

Syntypes.—Two syntypes are in the British Museum (Natural History).

Type-locality.—None selected. The 2 specimens representing the syntype series were collected at 2 different CHALLENGER stations. One was taken at station II off Portugal (38°10′N, 09°14′W) and the other was taken off the Virgin Islands. Considering the confusion regarding identification of species in this genus, there is a good chance that the 2 specimens referred to *E. rhysus* may represent 2 different species. It is therefore necessary to examine the syntypes and choose a lectotype before a type-locality can be defined.

Material examined.—ALBATROSS sta. 2415; 1, *ex* USNM 108421.—ALBATROSS sta. 2654; 5, USNM 330606.—Straits of Florida: G-368; 2, UMML 30-8054.—G-1106; 1, UMML 30-8095.—G-130; 1, UMML 30-8041.—G-859; 1, UMML 30-8163.

Geographic distribution.—Apparently amphi-Atlantic: reported from off Portugal (CHALLENGER sta. II), and known in the Western Atlantic from off northeastern Flor-



FIGS. 39–46. 39–40. *Echinogurges rhysus* (Watson): G-1106, h = 4.0 mm, d = 3.1 mm. 41–42. *Echinogurges anoxius* (Dall) (syntype): ALBATROSS-2668, h = 3.8 mm, d = 2.9 mm. 43–44. *Echinogurges clavatus* (Watson): G-965, h = 4.2 mm, d = 3.0 mm. 45–46. *Echinogurges tubulatus* (Dall) (holotype): ALBATROSS-2668, h = 3.7 mm, d = 3.5 mm.

ida, the Straits of Florida, and off Sombrero, Virgin Islands.

Bathymetric range.—From 805 to 1723 m.

Remarks.—*E. rhysus* has long been overlooked as is evident from the short synonymy. The last worker to mention this species in the scientific literature seems to have been Pilsbry in 1889, although his treatment was merely a literature compilation, adding nothing new. This species had been reported only from off Portugal and the Virgin Islands by Watson, so the present material represents a substantial extension of its range.

Occasional specimens of *rhysus* have fine intercalary spirals in the intercarinal spaces and some have traces of the axial sculpture persisting onto the last whorl, particularly below the peripheral carina.

Echinogurges tubulatus (Dall, 1927)
Figs. 45,46

Solariella tubulata Dall, 1927a: 130.

Description.—Shell small, conical, carinate, umbilicate, white, of about 3 whorls. Protoconch rather large, smooth, of about 1½ to 2 whorls. Spiral sculpture of 2 strong carinae, forming a wide, square periphery, and a somewhat weaker 1 defining the base. Space between the suture and the upper carina wide, rather flat, with fine prosocline growth lines; between the 3 carinae there are numerous strong axial cords which nodulate the spirals. Base slightly convex, usually with 4 very faint spiral threads; umbilicus narrow, microscopically rugose. Aperture subcircular, slightly angulated by the spiral sculpture; lips thin; inner lip slightly reflected; columella thin, slightly arched.

Syntypes.—Syntype series of 2 specimens; USNM 108109, from ALBATROSS sta. 2668.

Type-locality.—ALBATROSS sta. 2668, 30°58′30″N, 79°38′30″W, in 538 m.

Material examined.—ALBATROSS sta. 2668; 2, USNM 108109 (syntypes).—ALBATROSS sta. 2415; 7, USNM 108415.—Straits of Florida: G-23; 1, UMML 30-8079.

Geographic distribution.—Known only from off southeastern Georgia and the Straits of Florida off Miami.

Bathymetric range.—538 to 805 m.

Remarks.—This is a very well-marked species, with its characteristic flat shoulder and square periphery separating it immediately from any other species. It seems to fit best in *Echinogurges,* but whether it really belongs here must await examination of soft parts.

The specific name *tubulata* is evidently a mistake for Dall's originally intended name "*tabulata,*" which is a much more appropriate name. However, only a label in the type lot indicates this and it is impossible to determine whether the published spelling was a typographical error or a mistake by Bartsch who published the paper after Dall's death. Under the rules of nomenclature, *tubulatus* must stand as the specific name.

Subfamily Umboniinae Pilsbry, 1886

Genus **Gaza** Watson, 1879

Gaza Watson, 1879: 601; 1886: 93.
Callogaza Dall, 1881: 49 (*partim*).

Type-species.—*Gaza daedala* Watson, 1879; by monotypy.

Diagnosis.—"Shell turbinate to depressed turbinate, rather thin, generally highly opalescent. Umbilicus deep, rather wide and partially or completely covered by a columellar pad or callus. Operculum corneous, multispiral, thin and colored a pale amber." (Clench & Abbott, 1943.)

Remarks.—*Gaza* is a beautiful and very distinct genus of trochids. It is restricted to deep water and possesses a thin, highly nacreous shell which readily separates it from other genera. It has been considered rather rare, but recent collections, especially in the Gulf of Mexico and southern Caribbean, have shown that *Gaza* is not uncommon, and may even be abundant in areas of mud and sand bottom in depths of 400–600 m. Like many other trochids, species of *Gaza* probably feed primarily on detrital material and possibly on minute infaunal organisms, such as benthic foraminifera.

Geographic distribution.—The few species known seem to be distributed in deep tropical waters, probably circumtropical, although I can find no species attributed to the Indian Ocean.

Bathymetric range.—Exclusively deep water, from about 200 to over 1000 m, with the exception of *G. (Callogaza) sericata* Kira from Japan, which occurs in rather shallow water (less than 200 m).

Subgenus **Gaza** Watson, 1879

Diagnosis.—Characters of the genus; sculpture of fine spiral lirations or smooth;

shell rather large, generally 20–40 mm in diameter; shell of one color, usually a straw or ivory.

Gaza (Gaza) superba cubana Clench & Aguayo, 1940

Gaza superba cubana Clench & Aguayo, 1940: 81, pl. 15, fig. 3.
Gaza (Gaza) superba cubana: Clench & Abbott, 1943: 3, pl. 3, figs. 1, 2.
Gaza (Gaza) superba: Abbott, 1974: 49, fig. 375a (listed as form of *G. superba*; figs. from Clench & Abbott, 1943).

Description.—See Clench & Abbott, 1943.

Holotype.—MCZ 135151, from ATLANTIS sta. 3448.

Type-locality.—ATLANTIS sta. 3448, off Sagua la Grande, 23°21′N, 79°56′W, in 695 m.

Material examined.—Straits of Florida: G-524; 1, UMML 30-7751.—G-917; 1, UMML 30-7677.—G-357; 1, UMML 30-6022.—G-815; 1, UMML 30-7560.—G-130; 1, UMML 30-8135.—G-111; 1, UMML 30-8089.—S. of Cozumel, Yucatan: P-602; 11, UMML 30-8136.

Geographic distribution.—The Northwest Providence Channel south through the Straits of Florida and Yucatan Channel.

Bathymetric range.—From 329 to 1089 m.

Remarks.—Clench & Abbott (1943) suggested that this form is specifically distinct from *G. superba* (Dall), but Abbott (1974) indicated that he considered it to be an infrasubspecific form of *superba*. I have not, as yet, been able to examine enough specimens of either species to enable me to resolve the problem. The few specimens I have seen and an examination of the ranges of the 2 forms indicates to me at least a separation at the subspecific level, and pending further research, I am leaving *cubana* as a subspecies of *superba*. *G. superba* differs from *cubana* in being larger, more inflated, and higher-spired. *G. superba* occurs throughout the Caribbean area and extends up into the northern Gulf of Mexico, while *cubana* is restricted to the Straits of Florida and the Yucatan Channel as far as is now known. *G. superba cubana* also seems to prefer the insular margin of the Straits, but occurs along the continental coast of southeastern Yucatan.

Gaza (Gaza) fischeri Dall, 1889

Gaza fischeri Dall, 1889a: 355, pl. 37, fig. 6; 1889b: 160, pl. 37, fig. 6 (listed only; fig. from 1889a).
Gaza fischeri: Pilsbry, 1889: 158, pl. 49, fig. 37 (description and fig. from Dall, 1889a).—Johnson, 1934: 73 (listed only).—Clench & Aguayo, 1938: 380.—Clench & Abbott, 1943: 4, pl. 3, figs. 3–5.—Abbott, 1974: 49, fig. 376 (listed only; figs. from Clench & Abbott, 1943).

Description.—See Dall, 1889a; Clench & Abbott, 1943.

Lectotype.—Selected by Clench & Abbott (1943), MCZ 7543, from BLAKE sta. 221.

Type-locality.—BLAKE sta. 221, off St. Lucia, 13°54′55″N, 61°06′05″W, 772 m.

Material examined.—Straits of Florida: G-918; 1, UMML 30-7678.—G-190; 1, UMML 30-8005.—G-226; 1, UMML 30-5711.—G-289; 2, UMML 30-5960.—G-365; 5, UMML 30-6024.—G-362; 4, UMML 30-6023.—G-130; 1, UMML 30-5526.

Geographic distribution.—The Straits of Florida and the Gulf of Mexico, and from Cuba south throughout the Caribbean Sea.

Bathymetric range.—From 600 to 1021 m.

Remarks.—This species is readily separated from the others in the comma-like axial plications on the early whorls and an umbilical pad which completely covers the umbilicus. The spiral sculpture is coarser than in *Gaza superba* or *G. superba cubana,* and there is a series of short radial plications around the umbilical margin (usually hidden by the umbilical pad) which are not present in the other species. *G. fischeri* appears to be the most common species of *Gaza* in the Western Atlantic although future trawling along the Caribbean coast of Central America may show one of the other species to be more common.

Subgenus **Callogaza** Dall, 1881

Callogaza Dall, 1881: 50; 1889a: 356.—Clench & Abbott, 1943: 5.

Type-species.—Callogaza watsoni Dall, 1881; by subsequent designation, Dall, 1889a: 356.

Diagnosis.—Differs from *Gaza s. s.* in having stronger spiral sculpture, a distinctly shouldered whorl, a mottled color pattern (not

a uniform color as in *Gaza*), and in generally being smaller.

Gaza (Callogaza) watsoni (Dall, 1881)

Margarita filogyra Dall, 1881: 42.
Callogaza watsoni Dall, 1881: 50.
Gaza (Callogaza) watsoni: Dall, 1889a: 356, pl. 22, fig. 7, 7a; pl. 24, fig. 2, 2a; 1889b: 160, pl. 22, fig. 7, 7a; pl. 23, fig. 1, 1a; pl. 24, fig. 2, 2a (listed only; figs. from 1889a).
Gaza (Callogaza) watsoni: Pilsbry, 1889: 158, pl. 49, figs. 25–28; p. 48, figs. 11, 12 (description from Dall, 1881 & 1889a; figs. from Dall, 1889a).—Johnson, 1934: 73 (listed only).—Clench & Abbott, 1943: 5, pl. 2, figs. 3, 4.—Abbott, 1974: 49, fig. 377 (listed only; fig. from Dall, 1889a).
Gaza watsoni: Clench & Aguayo, 1938: 381.

Description.—See Dall, 1881 and 1889a; Clench & Abbott, 1943.

Holotype.—MCZ 7544, from BLAKE sta. 12.

Type-locality.—BLAKE sta. 12, off Havana, Cuba, 24°34′N, 83°16′W, 66 m (not 177 fms as reported by Dall, 1881 & 1889; 117 fms, as reported by Clench & Abbott, 1943, is a misprint).

Material examined.—BLAKE sta. 12; 1, MCZ 7544.—BLAKE, sta. no. unrecorded, off Bahia Honda, Cuba, 402 m; 2, MCZ 7546 (paratypes of *Margarita filogyra*).—BLAKE sta. no. unrecorded, Yucatan Channel, 1170 m; 1, MCZ 7545 (holotype of *M. filogyra*); 1, MCZ 7547 (paratype of *M. filogyra*).—G-897; 2, UMML 30-7725.

Geographic distribution.—G. watsoni occurs around Cuba, south through the Antillean arc, and Brazil off the Para River.

Bathymetric range.—Known from 66–1170 m, but primarily inhabits depths greater than 250 m.

Remarks.—G. watsoni is a very distinctive species and cannot be confused with any of the other known Western Atlantic species. *Margarita filogyra* was described from immature specimens of *watsoni*. Dall, acting as first revisor in 1889, chose *watsoni* over *filogyra* as the species name. Fortunately, no subsequent author has attempted to revive *filogyra* and the name *watsoni* has been accepted. Only one other species of this subgenus seems to be known at present, *G. (C.) sericata* Kira, from Japan. However, *sericata* is a relatively shallow water form, living in 100–200 m.

Subfamily Calliostomatinae Thiele, 1924

Genus **Calliostoma** Swainson, 1840

Calliostoma Swainson, 1840: 218, 351
Conulus Nardo, 1840: 244 (*non* Leske, 1778)
Ziziphinus Gray, 1840: 147 (*nomen nudum*); 1843: 237
Stylotrochus Seguenza, 1876: 186 (*non* Haeckel, 1862).
Fluxina Dall, 1881: 51.
Manotrochus Fischer, 1885: 827.
Jacinthinus Monterosato, 1889: 79.
Ampullotrochus Monterosato, 1890: 145.
Dymares Schwengel, 1942: 1.

Type-species.—Trochus conulus Linnaeus, 1758; by subsequent designation: Herrmannsen, 1846: 154.

Diagnosis.—Shell trochoid, spire conical, base generally flattened, umbilicate or imperforate; interior of shell nacreous, exterior sculptured and calcareous, with nacreous sheen often showing through. Aperture rounded or oblique, smooth or lirate within, outer lip thin, base of columella thickened. Sculpture usually of smooth or beaded spiral cords. Operculum thin, corneous, circular, multispiral.

Remarks.—Swainson (1840) introduced the name *Calliostoma* without any designation of a type-species. His mention of *Trochus zizyphinus* as an example of the genus has been considered by some subsequent authors as monotypy. However, Swainson later in the same work (p. 351) listed 7 additional species with *Trochus zizyphinus* under *Calliostoma,* obviously not considering it a monotypic genus. I therefore agree with Woodring (1928) and Olsson (1971) that this does not constitute monotypy and that the subsequent designation of *Trochus conula* Martyn (=*T. conulus* Linnaeus) by Herrmannsen (1846) should stand.

The classification of *Calliostoma* has depended greatly on differences in shell morphology, especially the presence or absence of an umbilicus. This character has been used not only at the subgeneric level, but also to separate genera. However, Clench & Turner (1960) discarded this approach in favor of subgeneric groupings using jaw morphology and radular characters, since some species are umbilicate when young and become imperforate with maturity. They based their study on the jaws and radulae of 20 North Atlantic species, but since these

characters have been recorded for so few species from other geographic areas, we must await further work along these lines to determine whether these groupings are valid.

What little is known of the natural history of this genus has been summarized by Clench & Turner (1960). Most authors have considered species of *Calliostoma* to be strict herbivores or detrital feeders. Perron (1975), in a study of 3 shallow-water species of *Calliostoma,* established that at least some members of the genus are carnivorous, feeding on hydroids. It is still probable that deep-water species are primarily detrital feeders but may be opportunistic predators of hydroids.

Geographic distribution.—Calliostoma is widely distributed in tropical and temperate waters. As strictly defined it does not seem to enter Arctic or Antarctic waters, being replaced in the Antarctic by closely related genera such as *Photinula* Adams & Adams and *Photinastoma* Powell (Powell, 1951). The *Calliostoma* fauna of the western North Atlantic is rich, probably comprised of about fifty species.

Bathymetric range.—From the intertidal zone to over 2000 m. The deepest Atlantic record is 2330 m for *Calliostoma suturale* (Phillipi) collected west of Morocco by the TALISMAN. In the western North Atlantic *C. occidentale* (Mighels & Adams) was taken alive in 1792 m by the BLAKE off Georges Bank, and several species were collected by the BLAKE in 1472 m in the Straits of Florida off Havana, Cuba.

Subgenus **Calliostoma** Swainson, 1840

Type-species.—T. conulus Linnaeus, 1758, by subsequent designation; Herrmannsen, 1846: 154.

Diagnosis.—Shells generally imperforate, marked with axial flames of reddish brown or unicolored. Sculptured with beaded cords, occasional species are found having these cords beaded only on the early whorls. Aperture subquadrate. Radula with a denticulate central tooth, five rather uniform lateral teeth, the first marginal tooth broad, the succeeding marginals becoming more attenuate, and having numerous, fine denticles. Jaw subcircular with their anterior ends broadly rounded and with a short fringe.

Calliostoma (Calliostoma) pulchrum
(C. B. Adams, 1850)

Trochus pulcher C. B. Adams, 1850: 69.—Dall, 1889a: 366.—Clench & Turner, 1950: 331, pl. 40, fig. 7.

Calliostoma pulcher: Dall, 1889b: 162 (listed only).—Pilsbry, 1889: 375.

Calliostoma veliei Pilsbry, 1900: 128.

Calliostoma (Calliostoma) pulchrum: Clench & Turner, 1960: 17, pl. 3, fig. 3; pl. 14.—Abbott, 1974: 42, fig. 306.

Description.—See Clench & Turner, 1960.

Holotype.—MCZ 156356, from Jamaica.

Type-locality.—Jamaica.

Geographic distribution.—North Carolina, Florida, the Bahamas, Cuba, the Gulf of Mexico and the northern Caribbean.

Bathymetric range.—This species is not uncommon in depths of less than 2 m to about 150 m, with only 1 specimen taken in greater depths (Pourtalès, collected at an unspecified locality in the Straits of Florida, 366 m, USNM 83382).

Remarks.—See *Remarks* under *C. roseolum. C. pulchrum* seems to prefer depths of less than 150 m, with the 1 exception of the Pourtalès specimen. This is probably merely a fortuitous occurrence. The specimen was dead when collected and, because of the precipitous nature of much of the Straits area, the specimen might easily have been carried to this depth by currents or perhaps a fish.

Calliostoma (Calliostoma) roseolum
Dall, 1881

Calliostoma roseolum Dall, 1881: 45; 1889b: 162, pl. 24, figs. 6, 6a (name only, figures taken from Dall, 1889a).—Pilsbry, 1889: 373, pl. 49, figs. 35, 36 (description from Dall, 1881; figures from Dall, 1889a).—Johnson, 1934: 70 (name only).

Calliostoma apicinum Dall, 1881: 46; 1889b: 162, pl. 24, figs. 3, 3a (name only, figures from Dall, 1889a).—Pilsbry, 1889: 379, pl. 60, figs. 1, 2 (description from Dall, 1881; figures from Dall, 1889a).—Johnson, 1934: 69 (name only).

Calliostoma (Calliostoma) roseolum: Dall, 1889a: 366, pl. 24, figs. 6, 6a.—Clench & Turner, 1960: 19, pl. 4, fig. 3; pl. 15.—Abbott, 1974: 43, fig. 307.

Calliostoma (Calliostoma) apicinum: Dall, 1889a: 366, pl. 24, figs. 3, 3a.

Description.—See Clench & Turner, 1960; Dall, 1889a.

Holotype.—MCZ 7563, from BLAKE sta. 11.

Type-locality.—BLAKE sta. 11, 24°43′N, 83°25′W, off Havana, Cuba, 68 m.

Record.—BLAKE sta. 56 (23°09′N, 82°21′W, off Havana, Cuba, in 320 m).

Geographic distribution.—North Carolina, both sides of Florida, west to Mexico, and the Lesser Antilles.

Bathymetric range.—From 13 to 320 m.

Remarks.—This species can be distinguished from *C. pulchrum* by being proportionally higher, more coarsely sculptured (especially on the base), and generally having less color. Like *C. pulchrum, C. roseolum* is a relatively shallow water species, occurring commonly in depths of less than about 150 m. The BLAKE station in the Straits (see above) and an unspecified BLAKE station off Barbados in 100 fms (183 m) are the only records of this species from 100 fms or more. Again, these may be no more than accidental occurrences since both records are near very steep slopes down which the shells may have fallen or been carried by currents.

Calliostoma (Calliostoma) yucatecanum
Dall, 1881

Calliostoma yucatecanum Dall, 1881: 47.

Calliostoma (Eutrochus) yucatecanum: Dall, 1889a: 370, pl. 24, figs. 4, 4a; 1889b: 162, pl. 24, figs. 4, 4a (name only, figures from Dall, 1889a).—Pilsbry, 1889: 407, pl. 48, figs. 19, 20 (description from Dall, 1881; figures from Dall, 1889a).

Calliostoma (Leiotrochus) yucatecanum: Johnson, 1934: 70 (name only).

Calliostoma (Astele) agalma Schwengel, 1942: 1, fig. 1.

Calliostoma (Calliostoma) yucatecanum: Clench & Turner, 1960: 27, pl. 4, fig. 4; pl. 8, fig. 4; pl. 19.—Abbott, 1974: 43, fig. 309.

Description.—See Dall, 1889a; Clench & Turner, 1960.

Holotype.—MCZ 7567, BLAKE (station number not recorded) from the Yucatan Strait in 1170 m.

Material examined.—Off Cay Sal Bank: G-984; 1, UMML 30-8004.—BLAKE, station number not recorded, Yucatan Strait, 1170 m; 1, MCZ 7567 (holotype).

Geographic distribution.—North Carolina, Florida and the Gulf of Mexico south to Yucatan.

Bathymetric range.—From 9 to 1170 m; see *Remarks.*

Remarks.—The GERDA specimen represents an extension of the previously known geographic range of this species. Clench & Turner (1960) suggested that *C. yucatecanum* might be found in this general area despite the absence of the species in the extensive dredgings of the EOLIS. In addition to predicting this range extension, they cast doubt on the depth record for the holotype (1170 m). All other records for the species fall between 9 and 64 m and there is no record of a BLAKE station of 1170 m in the Yucatan Strait in the published station data for the BLAKE (Peirce & Patterson, 1879; Smith, 1889). The GERDA specimen does not necessarily confirm a deep habitat for this species. It was dead when collected and was taken in an area where, because of the steep slope, the shell could easily have washed out into deeper water after death. Consequently, I doubt that *C. yucatecanum* lives in depths much exceeding 90 m.

Calliostoma (Calliostoma) echinatum
Dall, 1881

Calliostoma echinatum Dall, 1881: 47; 1889a: 364, pl. 21, figs. 2a, 5; 1889b: 162, pl. 21, figs. 2a, 5 (name only, figures from Dall, 1889a).—Pilsbry, 1889: 377, pl. 49, figs. 40, 41 (description from Dall, 1881; figures from Dall, 1889a).—Johnson, 1934: 69 (name only).—Clench & Turner, 1960: 55, pl. 36.—Abbott, 1974: 46, fig. 336.

Description.—Shell attaining 10 mm in height, conical, with extended spire, imperforate, highly sculptured, with 7½ slightly convex whorls. Color light tan, with faint axial flammules of deep pink regularly arranged around the periphery. Protoconch of 1½ whorls, smooth and polished, whitish. First whorl with low axial ridges beaded by 2 spiral cords, giving a cancellate aspect to the whorl. The axials persist on the second whorl but disappear afterward. Number of spirals increase by intercalation from the initial 2 to 11 at the aperture. Spirals generally alternate in size, the body whorl having 6 major tubercled cords with weak smooth cords in the spaces between the majors. A cord at, or just above, the periphery is especially strong on the early whorls, giving the spire a pagoda-like appearance, but becoming less conspicuous on the later whorls. In addition to the major spiral sculpture, there are microscopic incised spiral lines on the first 3 whorls. Base slightly convex, imperforate, with 13 spiral cords which are more undulate than beaded. Aperture

subquadrate, thickened in adults by a grooved layer of nacre. Outer lip thin and slightly crenulated by the external sculpture. Columella white, slightly arched and twisted, truncate anteriorly. Operculum and animal unknown.

Holotype.—USNM cat. no. 214270, from BLAKE sta. 62.

Type-locality.—BLAKE sta. 62, off Havana, Cuba, 146 m.

Material examined.—Northern Straits of Florida: G-636; 1, UMML 30-7996.—Cay Sal: G-986, 1, UMML 30-7997.—Southern Straits of Florida: BLAKE sta. 62, off Havana, Cuba, 146 m; 1, USNM 214270 (holotype).—Virgin Islands: J-S Exp. sta. 10, 18°29′20″N, 66°05′30″W, 220–293 m, 2 Feb. 1933, 9′ tangle; 1, USNM 429727.—J-S Exp. sta. 104, 18°30′40″N, 66°13′20″W, 146–220 m, 8 March 1933, oyster trawl; 1, USNM 430055.

Geographic distribution.—Off the NW corner of the Great Bahama Bank, Cay Sal, the northern coast of Cuba and the Virgin Islands.

Bathymetric range.—From 87 to 293 m.

Remarks.—The 2 GERDA specimens are only the 4th and 5th specimens collected of this rare species. Other than the holotype are 2 specimens collected by the Johnson-Smithsonian Expedition in 1933. All 5 records are in the Greater Antilles, but the species may be found in the future farther south in the Antillean arc.

The holotype of *echinatum* is a young specimen 5.4 mm high and the GERDA specimens are both mature, measuring 10 mm high. Since these are mature, I have chosen to redescribe the species. This species is very similar to *C. roseolum* Dall. With maturity *echinatum* assumes the rounded periphery and convex base of *roseolum*. *C. echinatum* can be easily distinguished from *roseolum* by its sharp, conical beading above the periphery, having the cords alternating in strength, and the smoothish basal cords. On the basis of its extreme conchological similarity to the group of *roseolum*, I am assigning *echinatum* to *Calliostoma* (*s. s.*). This allocation cannot be confirmed until the radula and jaws have been described.

Subgenus **Elmerlinia** Clench & Turner, 1960

Type-species.—*Trochus jujubinus* Gmelin, 1791; by original designation, Clench & Turner, 1960: 29.

Diagnosis.—"Shell perforate in all known species, marked with axial flames of reddish brown or nearly unicolored. Sculpture with beaded cords. Aperture subquadrate with the columella arched and truncated at the base. Radula with a central tooth having serrate or denticulate margins, 6 lateral teeth, 4 of which are denticulate, the 2 outer laterals plate-like or with extremely slender cusps. First 2 marginal teeth narrow with rather large denticulations; remaining marginal teeth long and finely denticulate. Jaws long, with the anterior ends sharply rounded and with a long fringe at the anterior margin." (Clench & Turner, 1960).

Calliostoma (Elmerlinia) jujubinum (Gmelin, 1791)

Trochus jujubinus Gmelin, 1791: 3570.—Philippi, 1847b: 37, pl. 7, figs. 8, 9; pl. 13, fig. 5.—Fischer, 1875: 80, pl. 18, fig. 2 (*non* Röding, 1798).

Trochus lunatus Röding, 1798: 82.

Trochus perspectivus 'Koch' Philippi, 1843: 32, pl. 1, fig. 5 (*non* Linnaeus, 1758; *non T. perspectivus* A. Adams, 1864).

Trochus tampaensis Conrad, 1846: 26, pl. 1, fig. 35.

Zizyphinus jujubinus: Reeve, 1863: fig. 12.

Eutrochus alternatus Sowerby, 1874: 719, pl. 59, fig. 5.

Calliostoma (Eutrochus) jujubinum: Dall, 1889a: 369; 1889b: 162 (listed only).—Pilsbry, 1889: 404, pl. 40, fig. 16.

Calliostoma (Eutrochus) jujubinum tampaensis: Dall, 1889a: 369; 1889b: 162 (listed only).

Calliostoma (Eutrochus) jujubinum rawsoni Dall, 1889a: 369; 1889b: 162 (listed only).—Pilsbry, 1889: 405.

Calliostoma (Eutrochus) jujubinum var. *perspectivum*: Pilsbry, 1889: 405, pl. 66, figs. 35, 36.

Calliostoma (Leiotrochus) jujubinum jujubinum: Johnson, 1934: 70 (listed only).

Calliostoma (Leiotrochus) jujubinum perspectivum: Johnson, 1934: 70 (listed only).

Calliostoma (Leiotrochus) jujubinum rawsoni: Johnson, 1934: 70 (listed only).

Calliostoma (Elmerlinia) jujubinum: Clench & Turner, 1960: 31, pl. 5, fig. 2; pl. 9, fig. 1; pl. 21.—Abbott, 1974: 44, fig. 312; pl. 2, fig. 312.

Description.—See Clench & Turner, 1960.

Holotype.—The figures representing the type of *T. jujubinus* Gmelin are numbers 1612 and 1613 on Plate 167 of Chemnitz (1781).

Type-locality.—Gmelin originally gave the locality as cited by Chemnitz: "ad insulam S. Mauritii, et in mari Americam australem alluente." Clench & Turner (1960) restricted the type-locality to St. Croix, Virgin Islands.

Material examined.—Northern Straits of Florida: G-984; 1, UMML 30-8003.

Geographic distribution.—Florida, Texas south to Colombia, and the Bahamas south throughout the West Indies.

Bathymetric range.—From the intertidal zone to 192 m.

Remarks.—*Calliostoma jujubinum* is another shallow-water species, probably the most common *Calliostoma* in the Western Atlantic. This species evidently does not form a part of the fauna found deeper than 180 m as the GERDA specimen might indicate. This specimen was taken at the same station as reported for *C. yucatecanum* (off Cay Sal Bank) and was most likely transported artificially to deep water with *C. yucatecanum* (see also *Remarks* under *C. yucatecanum*). *C. jujubinum* otherwise does not occur below 150 m.

Subgenus **Kombologion** Clench & Turner, 1960

Type-species.—*Calliostoma bairdi* Verrill & Smith, 1880; by original designation, Clench & Turner, 1960: 37.

Diagnosis.—"Shell usually imperforate, though generally with an umbilical depression. Sculpture consists of numerous beaded cords which may cover the entire surface or be formed only at the whorl periphery or above the base. Radula with 5 to 7 nearly uniform lateral teeth, the first and second marginal teeth rather long and not too dissimilar to the remaining marginal teeth. Outermost marginal teeth non-serrated. Jaws rounded, the anterior ends rather broadly rounded and having a very short edge of fringe along the anterior margin." (Clench & Turner, 1960.)

Calliostoma (Kombologion) psyche Dall, 1889

Calliostoma psyche Dall, 1878: 61 (*nom. nud.*); 1880: 45 (*nom. nud.*).

Calliostoma (Calliostoma) bairdii psyche Dall, 1889a: 364.

Calliostoma bairdii psyche: Pilsbry, 1889: 376.

Calliostoma (Kombologion) psyche: Clench & Turner, 1960: 39, pl. 7, fig. 1; pl. 25.

Calliostoma (Kombologion) bairdii psyche: Abbott, 1974: 44, fig. 316.

Calliostoma subumbilicatum 'Dall' Abbott, 1974: 44.

Description.—See Clench & Turner, 1960.

Lectotype.—Selected by Clench & Turner (1960) is in the MCZ, cat. no. 224572, collected by Pourtalès.

Type-locality.—Off the Florida Reefs in 183 to 366 m.

Material examined.—Northern Straits of Florida: off Palm Beach, 146–165 m, Thompson & McGinty coll.; 3, USNM 666964.—EOLIS sta. 346, ESE of Fowey Rocks, 238 m; 3, USNM 438136.—EOLIS sta. 358, off Fowey Rocks, 229 m; 3, USNM 438142.—EOLIS sta. 360, off Fowey Rocks, 183 m; 1, USNM 438146.—EOLIS sta. 361, off Fowey Rocks, 137–183 m; 10, USNM 438145.—EOLIS sta. 368, off Ajax Reef, 146–183 m; 2, USNM 438166.—G-847; 7, UMML 30-7609.—G-606; 1, UMML 30-7416.—Southern Straits of Florida: G-483; 2, UMML 30-7987.—G-484; 2, UMML 30-6993.—G-432; 6, UMML 30-7591.—G-459; 3, UMML 30-6048.—EOLIS sta. 330, off Sambo Reef, 220 m; 2, USNM 438173.—EOLIS sta. 331, off Sambo Reef, 216 m; 2, USNM 438175.—EOLIS sta. 15, 8 km S of Sand Key, 183 m; 2, USNM 438153.—EOLIS sta. 323, off Sand Key, 201 m; 7, USNM 438158.—BLAKE, station number unrecorded, off Sand Key, 234 m; 1, USNM 95003.—Off Dry Tortugas, 229 m, collected by J. A. Weber; 1, USNM 696741.

Geographic distribution.—From off North Carolina south along the east coast of Florida, the Florida Keys, and then north along the west coast of Florida to about Tarpon Springs.

Bathymetric range.—From 26 to 443 m. This species seems to prefer depths of about 150 to 200 m.

Remarks.—This species is extremely similar to *C. bairdii* Verrill & Smith. The resemblance is striking enough for most authors to consider *C. psyche* merely a subspecies of *C. bairdii.* However, Clench & Turner (1960) separated *C. psyche* as a distinct species using several characters: *C. psyche* is smaller, proportionately wider, more finely sculptured, with more color and an external sheen. In addition, the radula of *C. psyche* has six lateral teeth and that of *C. bairdii* has seven. I have seen a specimen of what I believe to be *C. psyche* from the Gulf of Mexico (in the collection of Donna Black) which is larger than the largest recorded *C. bairdii,* so the size may not be of prime importance. The other differ-

ences seem to be fairly constant, especially the radular differences, and on this basis I must agree with Clench & Turner that *C. psyche* is a distinct and valid species.

C. psyche seems to prefer the lower shelf and upper slope areas of the continental margin. There are no records of its occurrence along the insular margin of the Straits area (along the Bahamas or Cuba). This may be due to the extreme steepness of the insular margin which affords little or no horizontal area on which to live and feed. Most deep-water calliostomas live on mud bottoms where presumably they feed on detritus.

Calliostoma (Kombologion) hendersoni
Dall, 1927

Calliostoma hendersoni Dall, 1927b: 7.
Calliostoma (Leiotrochus) hendersoni: Johnson, 1934: 70 (listed only).
Calliostoma (Kombologion) hendersoni: Clench & Turner, 1960: 43, pl. 7, fig. 4; pl. 11, fig. 2; pl. 28.—Bayer, 1971; 121, fig. 4 (right).—Abbott, 1974: 44.

Description.—See Clench & Turner, 1960.

Holotype.—USNM 333703; from EOLIS sta. 331.

Type-locality.—EOLIS sta. 331, off Sambo Reef, Florida, 216 m.

Material examined.—Southern Straits of Florida: G-598; 2, UMML 30-7990.—G-813; 3, UMML 30-7531.—G-482; 1, UMML 30-6987.—G-134; 1, UMML 30-5530.—G-837; 1, UMML 30-7994.—G-866; 1, UMML 30-7618.—G-132; 3, UMML 30-7995.—G-839; 1, UMML 30-7566.—OREGON sta. 1349 (24°03′N, 80°30′W, 274 m; 2, H. Bullis).—EOLIS sta. 331, off Sambo Reef, 216 m; 1, USNM 333703.

Geographic distribution.—*C. hendersoni* is found only along the Florida Keys, from off Alligator Reef (Bayer, 1971) to SE of Key West.

Bathymetric range.—This species has a possible depth range of 133 to 288 m, but seems to be found most frequently near 200 m.

Remarks.—This adds 3 more records (G-132, G-589, G-837) to those reported by Bayer (1971), all within the established range of the species. A specimen from off Alligator Reef (TURSIOPS sta. 10, position not recorded, 133–154 m, 23 June 1966, UMML 30-7982) increases the known size of the species from 19.5 mm (height), 23 mm (width), to 23 mm (height), 27.5 mm (width).

The umbilicus of this species is rather narrow and usually open, but the specimen from G-866 has the umbilicus filled with callus, leaving only a pit-like umbilical depression. Abbott (1974) suggests that this is only a form of *C. psyche.* However, *C. hendersoni* can easily be distinguished from *C. psyche* by its generally open umbilicus, smooth basal cords and completely different radula (see Clench & Turner, 1960: pl. 7, figs. 1 & 4). The two species are also found in the same geographical area (the Florida Keys) and the same depth range (about 200 m). I must therefore consider *C. hendersoni* a distinct species.

Calliostoma (Kombologion) schroederi
Clench & Aguayo, 1938

Calliostoma (Calliostoma) schroederi Clench & Aguayo, 1938: 377, pl. 23, fig. 3.
Calliostoma (Kombologion) schoederi: Clench & Turner, 1960: 45, pl. 7, fig. 2; pl. 11, fig. 1; pl. 29.—Bayer, 1971: 118, fig. 3.—Abbott, 1974: 45, fig. 329 (listed only).

Description.—See Clench & Aguayo, 1938; Clench & Turner, 1960.

Holotype.—MCZ 135002; from ATLANTIS sta. 2981.

Type-locality.—ATLANTIS sta. 2981, 22°48′N, 78°48′W, off Punta Alegre, Camaguey, Cuba, 412 m.

Material examined.—Northwest Providence Channel: G-915; 1, UMML 30-7627.

Geographic distribution.—From off the NW corner of Little Bahama Bank (Matanilla Shoal) south through the Bahamas to the Old Bahama Channel off Camaguey, Cuba.

Bathymetric range.—From 265 to 439 m is the possible range, but the minimum is probably about 300 m.

Calliostoma species not assigned to subgenera

Calliostoma sapidum Dall, 1881

Calliostoma sapidum Dall, 1881: 46; 1889b: 162, pl. 21, figs. 2, 4 (name only, figures from 1889a).—Pilsbry, 1889: 378, pl. 49, figs. 38, 39 (description from Dall, 1881; figures from Dall, 1889a).—Johnson, 1934: 70 (name only).—Clench & Turner, 1960: 53, pl. 34, fig. 2.—Abbott, 1974: 46, fig. 334 (listed only).
Calliostoma (Calliostoma) sapidum: Dall, 1889a: 364, pl. 21, figs. 2, 4.

Description.—See Clench & Turner, 1960.

Holotype.—USNM 214271, from BLAKE sta. 2.

Type-locality.—BLAKE sta. 2, 23°14′N, 82°25′W, off Havana, Cuba, 1472 m.

Material examined.—Southern Straits of Florida: BLAKE sta. 2, 23°14′N, 82°25′W, off Havana, Cuba, in 1472 m; 1, USNM 214271 (holotype).

Geographic distribution.—Off Tampa, Florida, northern Cuba, Barbados and Antigua.

Bathymetric range.—From 121 to 1472 m.

Remarks.—This species, on conchological grounds, seems to belong in the subgenus *Calliostoma,* but until a specimen with soft parts is found, this is mere speculation. It seems to be closest to *C. pulchrum* (C. B. Adams), but is smaller and has a stronger, more heavily beaded peripheral cord.

Calliostoma torrei Clench & Aguayo, 1940

Calliostoma (Calliostoma) torrei Clench & Aguayo, 1940: 79, pl. 14, fig. 5.

Calliostoma torrei: Clench & Turner, 1960: 59, pl. 40.—Abbott, 1974: 46 (listed only).

Description.—See Clench & Aguayo, 1940; Clench & Turner, 1960.

Holotype.—MCZ 135165, from ATLANTIS sta. 1985.

Type-locality.—ATLANTIS sta. 1985, 23°13′N, 81°22′W, off Matanzas, Cuba, 704 m.

Record and distribution.—Known only from the holotype.

Remarks.—This appears to be the largest of all Western Atlantic species of *Calliostoma.* The holotype is 41 mm high and 36 mm wide and only *C. sayanum* Dall is close to this size.

Calliostoma cubanum Clench & Aguayo, 1940

Calliostoma (Calliostoma) cubanum Clench & Aguayo, 1940: 78, pl. 16, fig. 4.

Calliostoma cubanum: Clench & Turner, 1960: 61, pl. 43.—Abbott, 1974: 45 (listed only).

Description.—See Clench & Aguayo, 1940; Clench & Turner, 1960.

Holotype.—MCZ 135163, from ATLANTIS sta. 3474.

Type-locality.—ATLANTIS sta. 3474, 23°18′N, 80°46′W, off Cardenas, Cuba, 896 m.

Record and distribution.—Known only from the holotype.

Remarks.—This species is known only from a single, damaged specimen. It is, however, a very distinctive species and can be confused with no other.

Calliostoma atlantis Clench & Aguayo, 1940

Calliostoma (Calliostoma) atlantis Clench & Aguayo, 1940: 81, pl. 15, fig. 4.

Calliostoma atlantis: Clench & Turner, 1960: 62, pl. 44.

Calliostoma (Kombologion) atlantis: Abbott, 1974: 45 (listed only.)

Description.—See Clench & Aguayo, 1940; Clench & Turner, 1960.

Holotype.—MCZ 135164, from ATLANTIS sta. 3306.

Type-locality.—ATLANTIS sta. 3306, 23°04′N, 82°37′W, off Mariel, Pinar del Rio, Cuba, in 603 m.

Record and distribution.—Known only from the holotype.

Remarks.—This beautiful species is distinctive in being almost devoid of sculpture. It most nearly resembles *C. torrei* Clench & Aguayo, *C. cubanum* Clench & Aguayo, and *C. amazonica* Finlay, and bears a superficial resemblance to *C. schroederi* Clench & Aguayo.

Calliostoma jeanneae Clench & Turner, 1960

Calliostoma jeanneae Clench & Turner, 1960: 65, pl. 47, figs. 1, 2.—Abbott, 1974: 46 (listed only).

Description.—See Clench & Turner, 1960.

Holotype.—MCZ 228370, from ATLANTIS sta., station number unrecorded, off Havana, Cuba.

Record and distribution.—Known only from the holotype.

Remarks.—This species is like *C. atlantis* Clench & Aguayo in having very little sculpture, but this lack of sculpture and distinctive shape make *C. jeanneae* unlike any other in the Western Atlantic.

Calliostoma sayanum Dall, 1889

Calliostoma (Eutrochus) sayanum Dall, 1889a: 370, pl. 33, figs. 10, 11; 1889b: 162, pl. 33, figs. 10, 11 (name only, figures from

Dall, 1889a).—Pilsbry, 1889: 407, pl. 60, figs. 7, 8 (description and figures from Dall, 1889a).

Calliostoma (Leiotrochus) sayanum: Johnson, 1934: 70 (name only).

Calliostoma sayanum: Clench & Turner, 1960: 68, pl. 50, figs. 1–3.—Abbott, 1974: 45, fig. 320.

Description.—See Dall, 1889a; Clench & Turner, 1960.

Holotype.—USNM 61240, from ALBATROSS sta. 2594.

Type-locality.—ALBATROSS sta. 2594, 35°01′N, 75°12′W, SE of Cape Hatteras, North Carolina, 293 m.

Material examined.—Northern Straits of Florida: G-854; 1 damaged specimen, UMML 30-7610.

Remarks.—Northern Straits of Florida: off Palm Beach in 135 m, T. McGinty coll.—Southern Straits of Florida: off Sand Key Light, Key West, in 119 m, T. McGinty coll.—OREGON sta. 1009, 24°34′N, 83°34′W, about 74 kilometers W of Tortugas, 366 m, H. Bullis.

Geographic distribution.—From off Cape Hatteras, North Carolina to off the Dry Tortugas, Florida Keys.

Bathymetric range.—From 119 to 366 m.

Remarks.—*C. sayanum* is a large and very striking species. It resembles *C. springeri* Clench & Turner, but it is larger, more inflated, and has coarser sculpture and a narrower umbilicus.

Calliostoma bigelowi Clench & Turner, 1960

Calliostoma bigelowi Clench & Turner, 1960: 72, pl. 53, figs. 1, 2.—Abbott, 1974: 46, fig. 341 (listed only).

Description.—See Clench & Turner, 1960.

Holotype.—MCZ 135003, from ATLANTIS sta. 2963C.

Type-locality.—ATLANTIS sta. 2963C, 22°07′N, 81°08′W, off Bahía de Cochinos, Cuba, 375 m.

Record.—Southern Straits of Florida: ATLANTIS sta. 2999, 23°10′N, 81°29′W, off Matanzas, Cuba, in 265–421 m.

Geographic distribution.—The north and south coasts of Cuba.

Calliostoma brunneum (Dall, 1881)

Fluxina brunnea Dall, 1881: 52; 1889a: 273, pl. 22, figs. 6, 6a; 1889b; 148 pl. 22, figs. 6, 6a (name only, figures from Dall, 1889a).—Tryon, 1887: 16 (name only).—Johnson, 1934: 101 (name only).

Calliostoma (Astele) tejedori Aguayo, 1949: 94, pl. 4, fig. 7.

Calliostoma tejedori: Clench & Turner, 1960: 73, pl. 54, figs. 1, 2.

Calliostoma brunneum: Merrill, 1970a: 32.—Abbott, 1974: 46 (listed only).

Description.—See Dall, 1881; Clench & Turner, 1960.

Holotype.—MCZ 7463, from BLAKE sta. 2.

Type-locality.—BLAKE sta. 2, 23°14′N, 82°25′W, off Havana, Cuba, 1472 m.

Material examined.—Northern Straits of Florida: G-636; 1, UMML 30-7992.—Cay Sal: G-986; 2, UMML 30-7993.—Southern Straits of Florida: BLAKE, station number unrecorded, off Havana, Cuba, in 146 m; 1, USNM 94897.

Record.—Arenas de la Chorrera, near Havana, Cuba. This is a pile of construction sand dredged from 5–27 m off Santa Fe, near Havana.

Geographic distribution.—From the NW corner of the Great Bahama Bank south to Cuba, Jamaica, and Barbados.

Bathymetric range.—From 5–27 m to 1767 m.

Remarks.—*C. brunneum* was described by Dall in 1881 as the only species in the genus *Fluxina.* In 1889 he added a second species, *F. discula* (probably a *Basilissa*), and placed the genus in the Solariidae (=Architectonicidae). A specimen of this species was found in a pile of construction sand near Havana, and Aguayo (1949) correctly assigned it to *Calliostoma,* but he did not realize that his new species, *tejedori,* was conspecific with *F. brunnea.* The 2 species remained unquestioned until Merrill (1970a) examined the type of *F. brunnea* while researching the Atlantic Architectonicidae. He recognized that *tejedori* was the same as *brunnea* and synonymized *Fluxina* with *Calliostoma.*

This is a distinctive species, resembling in shape *C. bigelowi* and *C. springeri* Clench & Turner, but has very little sculpture on the body whorl and a brownish-red umbilicus. The only other species in the Western Atlantic with a colored umbilicus is *C. barbouri* (q.v.), but the 2 species are completely different in shell shape and sculpture.

Calliostoma cinctellum Dall, 1889

Calliostoma (Eutrochus) cinctellum Dall, 1889a: 372, pl. 32, figs. 1, 4; 1889b: 162, pl.

32, figs. 1, 4 (listed only; figs. from 1889a).—Pilsbry, 1889: 409, pl. 49, figs. 31, 32 (description and figs. from Dall, 1889a).—Clench & Turner, 1960: 80 (name only; generic placement questioned).

Calliostoma (Leiotrochus) cinctellum: Johnson, 1934: 70 (listed only).

Basilissa cinctellum: Abbott, 1974: 38, figs. 244 (listed only; fig. from Dall, 1889a).

Description.—See Dall, 1889a.

Holotype.—USNM 214274, from BLAKE sta. 101.

Type-locality.—BLAKE sta. 101, off Morro Light, Havana, Cuba, in 320–457 m.

Material examined.—BLAKE sta. 101; 1, USNM 214274 (holotype).

Geographic & bathymetric range.—Known only from the holotype.

Remarks.—This is a very striking and beautiful species. Dall, in his original remarks (1889a), stated that *cinctellum* "recalls *Basilissa* in its general appearance." Clench & Turner (1960) more directly suggested that the species was indeed a *Basilissa.* Abbott (1974) followed Clench & Turner and placed *cinctellum* in his list of *Basilissa* species. Dall, again in his original description, gave a careful account of the jaws and radula: "Jaws separate, squarish, composed of small horny obliquely set rods, whose lozenge-shaped end-sections reticulate the surface. . . . The rhachidian and (on each side) five laterals have broad simple bases with a pear-shaped outline; the cusps, which might be compared to the stem of the pear bent over, are extremely narrow and long and symmetrically serrate on each side with 4–6 serrations. The major uncinus is stout and has a large four-toothed ovate cusp; there are about twenty more slender uncini with scythe-like cusps serrate on the outer edge; outside of these are two or three of a flat form, like a section of a palm-leaf fan from handle to margin with four riblets, and the distal edge with three or more indentations. They (the uncini) are smooth, thinner toward the distal end, and have no distinct shaft." This description shows marked differences from the radula of *Basilissa alta*: "rhachidian with a triangular cusp finely denticulated on the sides, a wide lateral with an inwardly directly triangular cusp denticulated on both sides, and several (6 or 7) marginals, flat and rather narrow, denticulated along most of the outer edge but on the inner edge only near the tip" (Bayer, 1971: 124, fig. 7). Therefore, the radula of *cinctellum* differs from that of *Basilissa* in the number and structure of both the laterals and marginals. However, the radula of *cinctellum* corresponds quite closely to that of *Calliostoma s. s.* as defined and figured by Clench & Turner (1960). Examination of the holotype of *cinctellum* revealed no shell characters which would indicate that the species belongs in *Basilissa,* and on the basis of the radula, I prefer retaining the species in *Calliostoma s. l.* On conchological grounds, this species is very similar to *C. echinatum,* but differs in having a wider, more angular shell with flat whorls and an umbilicus (see also *C. echinatum*).

Calliostoma circumcinctum Dall, 1881

Calliostoma circumcinctum Dall, 1881: 44; 1889a: 364, pl. 22, figs. 3, 3a; 1889b: 162, pl. 22, figs. 3, 3a (listed only; figs. from 1889a).—Pilsbry, 1889: 376, pl. 49, figs. 33, 34 (description from Dall, 1881; figs. from Dall, 1889a).—Johnson, 1934: 69 (listed only).—Clench & Turner, 1960: 80 (listed only).—Abbott, 1974: 46 (listed only.)

Description.—See Dall, 1881.

Holotype.—MCZ 7558, from BLAKE sta. 2.

Type-locality.—BLAKE sta. 2, off Havana, Cuba, 23°14′N, 82°25′W, in 1472 m.

Material examined.—Yucatan Channel: G-897; 1, UMML 30-7716.—BLAKE, sta. number unrecorded, 1170 m; 1, USNM 95020.

Geographic distribution.—Off Havana, Cuba and the Yucatan Channel.

Bathymetric range.—This species has a possible depth range of 210–1472 m, but the 2 deep records (1170 and 1472 m) were both taken near steep escarpments. The GERDA specimen was collected alive between 200 and 300 m, indicating that the specimens collected by the BLAKE were carried to deeper water after death.

Remarks.—This is a very distinctive species, possessing sharp, lamellar spiral keels which immediately separate it from any other species of *Calliostoma.*

Calliostoma barbouri Clench & Aguayo, 1946

Calliostoma barbouri Clench & Aguayo, 1946: 89, text fig.—Clench & Turner, 1960: 67, pl. 49, figs. 1–3.—Abbott, 1974: 43, fig. 311.

Description.—See Clench & Aguayo, 1946; Clench & Turner, 1960.

Holotype.—MCZ 178128, from Havana, Cuba.

Type-locality.—From Havana, Cuba, in construction sand in Arenas de la Chorrera, dredged in 5–27 m near Havana.

Material examined.—Straits of Florida: G-984; 1, UMML 30-8001.—G-985; 1, UMML 30-8000.—Lesser Antilles: P-912; 1, UMML 30-8132.

Geographic distribution.—Cay Sal Bank, northern Cuba and the Lesser Antilles.

Bathymetric range.—This species has been taken as deep as 230 m, but the Cuban records indicate that it is really a rather shallow water species.

Remarks.—*C. barbouri* appears to be closely related to *C. javanicum* and *C. jujubinum,* and possibly *C. hassler* Clench & Aguayo. The character of *barbouri* which sets it apart from all these species is the presence of a brownish-red colored umbilicus. In this, *barbouri* resembles *C. brunneum,* but the shell shape of the two species is totally dissimilar. On the basis of shell morphology, I suspect that *barbouri* should probably be placed in the subgenus *Elmerlinia* with *javanicum* and *jujubinum.*

Genus **Dentistyla** Dall, 1889

Dentistyla Dall, 1889a: 373; 1889b: 162.—Pilsbry, 1889: 411.—Johnson, 1934: 70.—Abbott, 1974: 41.

Type-species.—*Margarita asperrima* Dall, 1881, by subsequent designation, Keen, 1960: I258.

Diagnosis.—Shell rather thin, conical, base slightly convex, usually umbilicate; exterior sculptured by spiral rows of close-set conical or rounded nodules, interior nacreous; aperture subquadrate, somewhat oblique, sometimes thickened within; columella straight, thickened, often with a strong tooth in mature specimens.

Remarks.—*Dentistyla* was erected as a subgenus of *Calliostoma* for the species *asperrima, dentifera* and *sericifila.* Since that time, however, the species have been variously assigned to other genera, and *Dentistyla,* if used, was generally accepted at the subgeneric level, either of *Calliostoma* or *Solariella. Dentistyla* is a very distinctive group, however, and the characters do not fit any other described group, although they most closely resemble those of *Calliostoma.* I think that the peculiar nodulous sculpture and presence of a columellar tooth are sufficient to separate the group at the generic level, retaining it within the Calliostomatinae.

Geographic distribution.—*Dentistyla* occurs from North Carolina south through the Straits of Florida to the extreme southern Gulf of Mexico, and the Caribbean Sea.

Bathymetric range.—Known from 66–914 m.

Dentistyla asperrimum (Dall, 1881)
Figs. 49,50

Margarita asperrima Dall, 1881: 40 (*partim*).

Calliostoma (Dentistyla) asperrimum: Dall, 1889a: 373; 1889b: 162 (listed only).—Pilsbry, 1889: 411 (description from Dall, 1881).—Johnson, 1934: 70 (listed only). Not *Calliostoma asperrimum* Guppy & Dall, 1896: 323 (=*guppyi* Woodring, 1928).

Calliostoma asperrimum: Woodring, 1928: 433.

Solariella (Dentistyla) asperrima: Clench & Turner, 1960: 79.—Abbott, 1974: 41 (listed only).

Astele (Dentistyla) asperrima: Keen, 1960: I258.

Description.—Shell attaining a height of 8.5 mm, conical, somewhat turreted, carinate, umbilicate, highly sculptured, of about 7 whorls. Protoconch small, glassy, of about 1 whorl. Spiral sculpture of 2 major nodulous cords, of which the lower forms the peripheral carina; between the major cords may be intercalated 1 or 2 similar but weaker cords. Below the periphery the whorl constricts sharply to a circumbasal cord which may be smoothish or finely beaded; base with 3 or 4 smoothish to finely beaded cords with 1 strongly beaded cord at the margin of the umbilicus. Axial sculpture of fine threads which are visible between the spirals, and the intersections of spirals and axials result in the nodulations. Base rounded; umbilicus narrow, axially rugose, sometimes with a very fine spiral thread near the marginal cord. Aperture oblique, subquadrate, somewhat thickened within; lips thin, outer lip crenulate, inner lip slightly reflected; columella straight, thickened, with a strong tooth in mature specimens. Periostracum thin, brownish.

Holotype.—MCZ 7568, from BLAKE sta. 12.

Type-locality.—BLAKE sta. 12, 24°34′N, 83°16′W, in 66 m.

Material examined.—Straits of Florida: Pourtalès Plateau, off the Florida Keys,

366 m, Nutting coll.; 2, USNM 107502.—BLAKE sta. 12; 2, USNM 95055 (paratype).—BLAKE sta. 20; 2, USNM 95056.—Yucatan Channel: G-947; 1, UMML 30-7733.—Caribbean: J-S sta. 102; 1, USNM 430365.—P-610; 3, UMML 30-8133.

Geographic distribution.—The southern Straits of Florida, the Yucatan Channel, and the Antillean arc.

Bathymetric range.—Known from 66 to 914 m, but probably occurs primarily in depths of 200 to 400 m.

Remarks.—This species is very closely related to *D. dentiferum* Dall and *D. sericifilum* Dall. Dall himself had difficulty separating *asperrimum* and *dentiferum*. He originally included both forms under *"Margarita" asperrima*. In 1889 he separated *dentifera* as a variety of *asperrima*. Only one specimen was designated as *dentifera* and the others left as *asperrima*. In examining the lots in the USNM, I discovered that the specimens were, for the most part, immature, and both species were present in several of the lots. *D. asperrimum* can be distinguished from *dentiferum* by its narrower umbilicus, whose walls have at most 1 spiral thread and often none, and its coarser sculpture. In mature shells, the nacreous thickening within the aperture is smooth, not lirate as in *dentiferum*. The *Antillachelus vaughani* Woodring, 1928, seems to be *D. dentiferum*, not *asperrimum* as suggested by Clench and Turner (1960).

Dentistyla dentiferum (Dall, 1889)
Figs. 47,48

Calliostoma (Dentistyla) asperrimum var. *dentiferum* Dall, 1889a: 373, pl. 23, figs. 7, 8; 1889b: 162, pl. 23, figs. 7, 8 (listed only; figs. from 1889a).—Pilsbry, 1889: 411, pl. 60, figs. 10, 11 (diagnosis and figs. from Dall, 1889a).

Basilissa (Ancistrobasis) near *costulata* Dall, 1903: 1585 (listed only).

Antillachelus dentiferum: Woodring, 1928: 433.

Antillachelus vaughani Woodring, 1928: 433, pl. 36, figs. 12–14.

Euchelus (Antillachelus) dentiferus: Keen, 1960: I250, fig. 161(6).—Abbott, 1974: 39, 41, fig. 260 (listed only).

Solariella (Dentistyla) dentifera: Clench & Turner, 1960: 79.

Calliostoma cf. *corbis*: Rice & Kornicker, 1965: 117, pl. 1, fig. 9.

Description.—Shell attaining a height of 8 mm, conical, carinate, umbilicate, highly sculptured, of about 7 whorls. Protoconch small, glassy, of about 1 whorl. Spiral sculpture of 2 major beaded cords, the lower of which forms the peripheral carina; from 1 to 3 similar cords are intercalated between, often becoming subequal to the primaries. Below the peripheral cord the whorl is sharply constricted to a beaded circumbasal cord; base rounded with 5 to 7 beaded cords, of which the innermost is strongest and defines the umbilicus. Axial sculpture of sharp riblets whose intersections with the spirals form the nodulations. Umbilicus moderate, axially striate, usually with one to three rather strong nodulous spiral cords. Aperture oblique, subquadrate, thickened within by nacre in which there are numerous sharp lirations; lips thin, outer lip somewhat crenulated, inner lip slightly reflected; columella straight, oblique, usually with a strong swelling or blunt tooth.

Holotype.—USNM 95059, from BLAKE sta. 299.

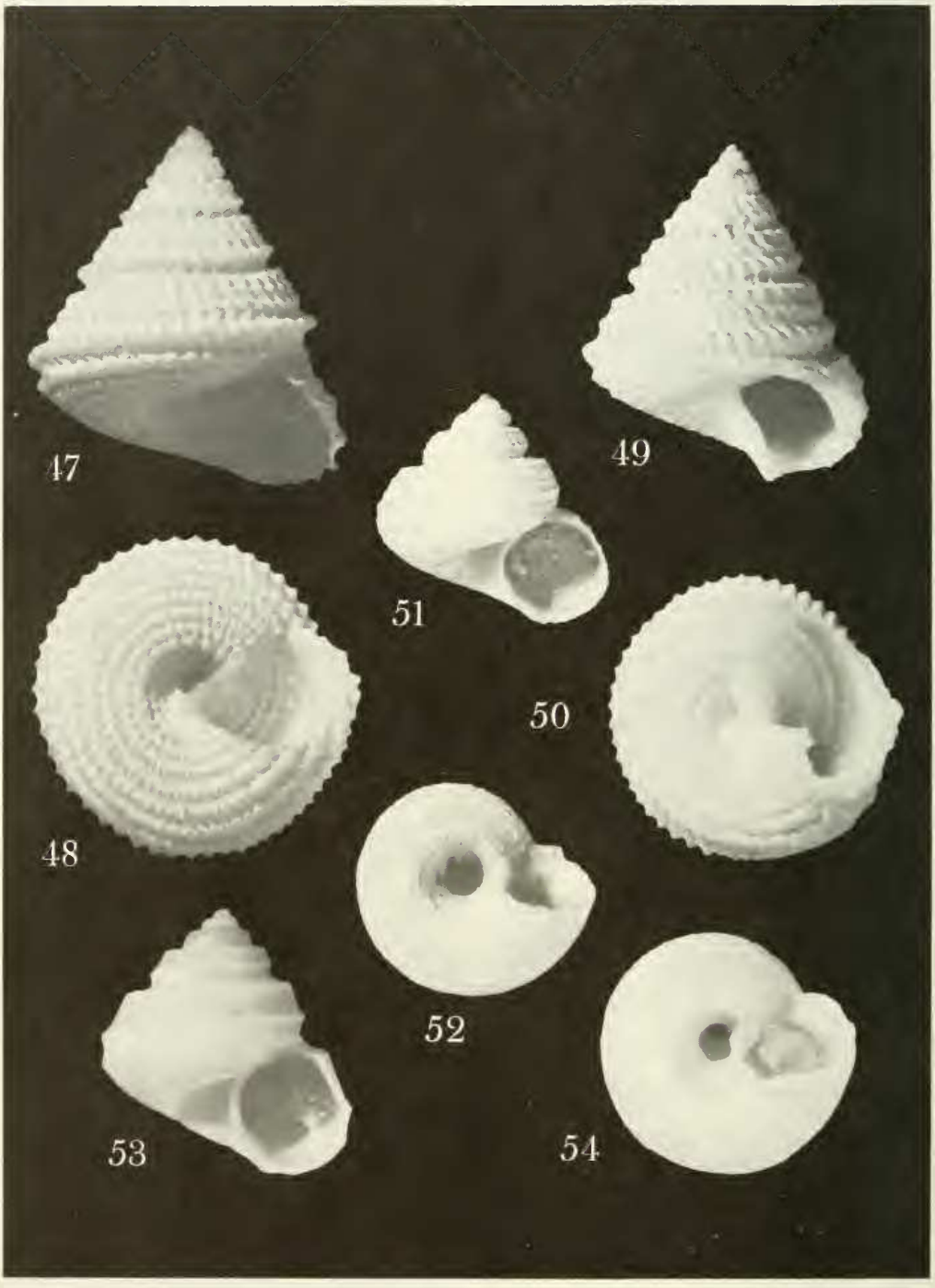
Type-locality.—BLAKE sta. 299, 13°05′N, 59°39′40″W, off Barbados, in 256 m.

Material examined.—ALBATROSS sta. 2602; 1, USNM 95054.—Straits of Florida: G-1011; 1, UMML 30-7635.—EOLIS sta. 329, off Sambo Reef, 247 m; 1, USNM 438325.—EOLIS sta. 320, off Western Dry Rocks, 146 m; 1, USNM 450568.—BLAKE sta. 20; 2, *ex* USNM 95056.—Kornicker sta. 1328, 21°50′N, 92°30′W, 168 m; 4, USNM 667860.—Caribbean: BLAKE, sta. no. unrecorded, off Barbados, 183 m; 1, USNM 95057.—BLAKE sta. 299; 1, USNM 95059 (holotype); 1, USNM 95098 (paratype).

Geographic distribution.—From off North Carolina, south through the Straits of Florida, the Campeche Bank, and the Lesser Antilles; it probably occurs throughout the Caribbean.

Bathymetric range.—From 146 to 311 m.

Remarks.—(See also *Remarks* section under *D. asperrimum* Dall.) This species is remarkably similar to *D. asperrimum*. *D. dentiferum* can be separated from *asperrimum* by its wider umbilicus with strong spiral sculpture within, its finer beading, more numerous basal cords, and especially by the presence of sharp lirations within the aperture. The external sculpture may be visible within the apertures of juveniles of both species as Clench & Turner observed, but in mature specimens there are grooves cut into the nacreous lining of *dentiferum* which are



FIGS. 47–54. 47–48. *Dentistyla dentiferum* (Dall): G-1011, h = 5.9 mm, d = 5.5 mm. 49–50. *Dentistyla asperrimum* (Dall): P-610, h = 7.5 mm, d = 6.8 mm. 51–52. *Solariella (Solariella) amabilis* (Jeffreys) "var. *affinis*" (Friele): PORCUPINE-61, h = 5.3 mm, d = 5.5 mm. 53–54. *Solariella (Solariella) amabilis* (Jeffreys): "off British Isles," h = 6.0 mm, d = 6.0 mm.

not related to the external sculpture. Specimens in USNM lots 95054, 95057 and 95058 were all identified as *asperrimum,* but in fact contained both species, and lot 95056 had *asperrimum, dentiferum,* and the turbinid *Homalopoma linnei* (Dall).

Subfamily Solariellinae Powell, 1951

Genus **Solariella** S. V. Wood, 1842

Margarita.—Auctt. (*partim*; *non* Leach, 1814).
Solariella S. V. Wood, 1842: 531.—Auctt. (*partim*).
Machaeroplax Friele, 1877: 311.—Sars, 1878: 136.
Calliotropis.—Auctt. (*partim*).

Type-species.—*Solariella maculata* S. V. Wood, 1842; by monotypy.

Diagnosis.—Shell small, generally less than 10 mm high, trochoid, with tubular whorls, usually widely umbilicate, umbilicus often bounded by a strong nodulous keel. Sculpture of spiral cords and collabral striae, or almost smooth. Radula short, broad, with few (10 or less) marginals.

Remarks.—*Solariella* was erected by S. V. Wood for a fossil species, *S. maculata,* from the Crag Formation of England. Friele (1877) based *Machaeroplax* on his *M. affinis* (*ex* Jeffreys MS) (Figs. 51, 52). *M. affinis* is merely a strongly lirate variant of *S. amabilis* (Jeffreys) (Figs. 53,54), and the range of characters exhibited by the varieties of *S. amabilis* bridges the gap between the forms resembling *S. lacunella, S. iris,* etc., and those of the *S. lamellosa* type. I am therefore following Thiele (1929) in regarding *Machaeroplax* as a junior subjective synonym of *Solariella s. s.*

Solariella, since being separated from the catch-all *Margarita* (=*Margarites* Gray, 1847), has in turn been used as a depository of miscellaneous species. Many of the species assigned to *Solariella* can be placed in *Calliotropis, Dentistyla* or *Microgaza.*

Geographic distribution.—Worldwide, in all oceans.

Bathymetric range.—Known from less than 50 m to well over 2000 m.

Solariella (Solariella) lacunella (Dall, 1881)
Figs. 55–58

Margarita maculata Dall, 1881: 43 (not S. V. Wood, 1842).
Margarita lacunella Dall, 1881: 102.
Margarita (Solariella) lacunella: Dall, 1889a: 381, pl. 21, figs. 1, 1a; 1889b: 164, pl. 21, figs. 1, 1a (listed only; figs. from 1889a).—Pilsbry, 1889: 322, pl. 51, figs. 32, 33 (description from Dall, 1881; figs. from Dall, 1889a).
Margarita (Solariella) lacunella depressa Dall, 1889a: 382; 1889b: 164 (listed only).—Pilsbry, 1889: 323 (from Dall, 1889a).
Solariella (Machaeroplax) lacunella lacunella: Johnson, 1934: 71 (listed only).—Abbott, 1974: 40, fig. 274.
Solariella (Machaeroplax) lacunella depressa: Johnson, 1934: 71 (listed only).

Description.—Shell attaining a height of about 8.5 mm, rather thin, depressed-conical, inflated, of about 7 whorls. Protoconch small, glassy, of 1–1½ whorls. Spiral sculpture of numerous subequal cords (usually 15–18 on the last whorl); inner 2 basal cords strong, usually strongly beaded, and separated from each other by a rather deep, narrow channel; there are usually 5 or 6 strong, beaded cords on the walls of the moderately wide umbilicus. Axial sculpture of fine plications radiating from the suture which crenulate or finely bead the upper 2–5 spirals, otherwise visible in the spiral interspaces as fine threads. Suture at the bottom of a channel formed by the overhanging periphery and the upper spiral cord. Aperture subcircular, thickened within by a layer of nacre; lips thin, crenulated by the sculpture, inner lip slightly flared. Color ivory to yellowish-white, with a slight nacreous sheen in some specimens, variously marked above with splotches and flammules of straw or reddish-brown.

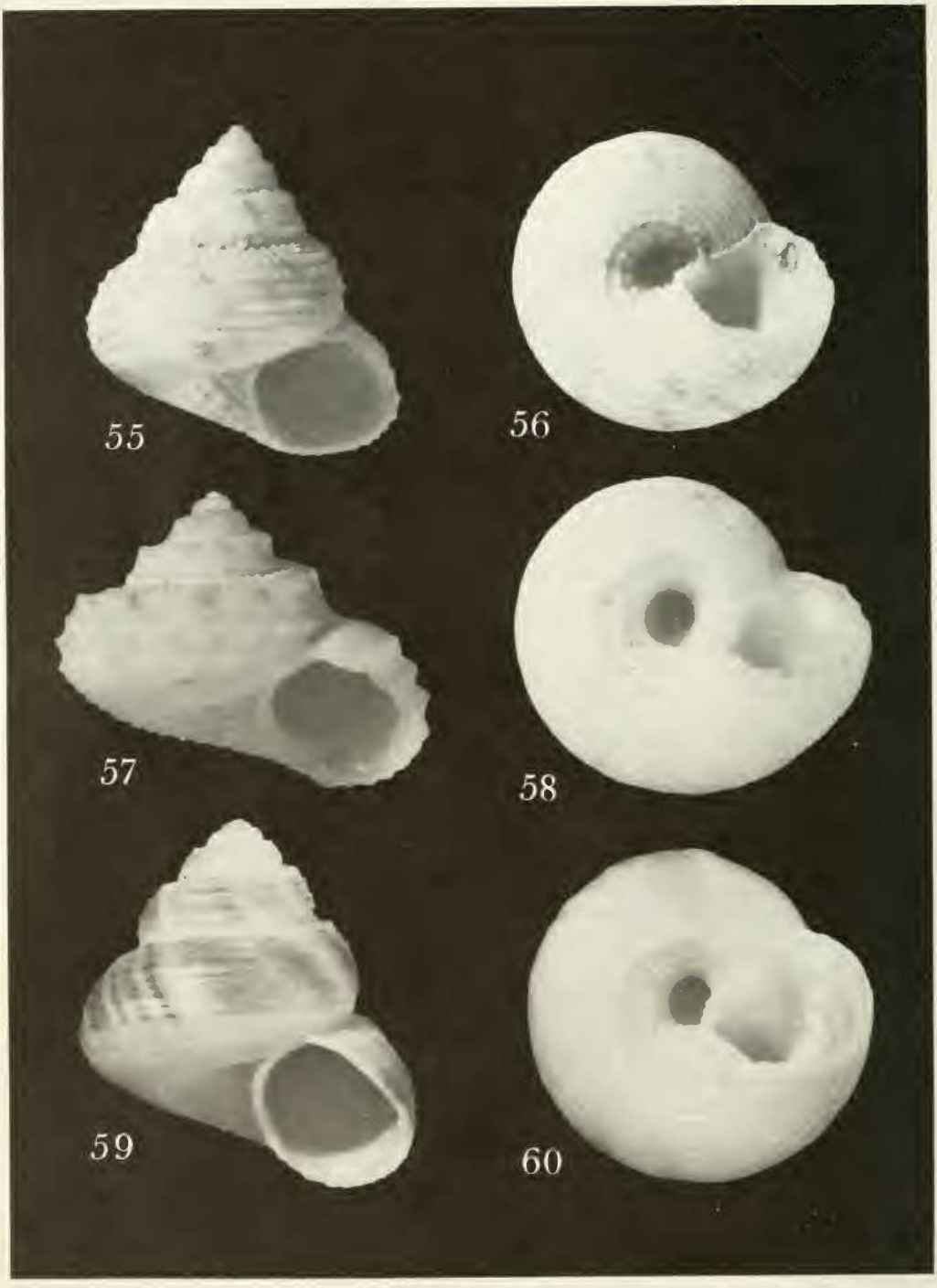
Holotype.—USNM 333705, from BLAKE sta. 2.

Type-locality.—BLAKE sta. 2, 23°14′N, 82°25′W, off Havana, Cuba, 1472 m.

Material examined.—Straits of Florida: EOLIS sta. 310, off Government Cut, Miami, 216 m; 2, USNM 438313.—EOLIS sta. 360, off Fowey Rocks; 183 m; 39, USNM 438386.—EOLIS sta. 153, 5½ km SE of Fowey Rocks, depth not recorded; 64, USNM 438352.—BLAKE sta. 2; 1, USNM 333705 (holotype).—Many lots from shallower depths in the Straits and many from the Lesser Antilles.

Geographic distribution.—From off North Carolina south through the Straits of Florida, the Gulf of Mexico, and the Antillean Arc to St. Lucia and Barbados.

Bathymetric range.—*S. lacunella* occurs commonly in depths from 20 to 150 m, with



FIGS. 55–60. 55–56. *Solariella (Solariella) lacunella* (Dall) (holotype): BLAKE-2, h = 8.7 mm, d = 8.3 mm. 57–58. *Solariella (Solariella) lacunella* (Dall) ("var. *depressa*" Dall, holotype): BLAKE-22, h = 3.7 mm, d = 4.8 mm. 59–60. *Solariella (Solariella) multirestis* Quinn, n. sp. (holotype): P-874, h = 11.8 mm, d = 11.5 mm.

occasional specimens known down to 1472 m, but most of the deeper records are for dead-collected material.

Remarks.—This is primarily a shallow-water species and does not form a major part of the molluscan fauna below 200 m. The variety described by Dall as *depressa* is known only from the holotype and appears to be merely a freak morphological variant and should not be considered at the subspecific rank.

Solariella (Solariella) multirestis
Quinn, n. sp.
Figs. 59,60

Description.—Shell large for the genus, reaching 11.8 mm, spirally striate, umbilicate, ivory-colored with axial flammules of light brown, iridescent when fresh, of 6 tubular whorls. Protoconch small, glassy, slightly depressed, of about 1½ whorls. Spiral sculpture above of 4 or 5 major cords with 1–3 intercalary cords between each pair; between the suture and the upper cord is a narrow shelf, on which there are several fine spiral threads on the later whorls. Axial sculpture of, on the early whorls, fine ribs which become restricted to the subsutural shelf on later whorls, and finally disappear on the final whorl. Base convex, with about 6 strong, subequal spiral cords and a spiral of strong beads bounding the umbilicus; umbilicus rather wide, very deep; walls convex with about 10 finely beaded spiral cords. Aperture subcircular, thickened within by a layer of nacre; lips thin, simple, inner lip slightly reflected; columella smooth, arched, not thickened. Operculum and radula unknown.

Holotype.—USNM 711107, from PILLSBURY sta. 874.

Type-locality.—P-874, 13°11.2′N, 61°05.3′W, off St. Vincent, Lesser Antilles, 156–201 m, 6 July 1969, 5′ BLAKE trawl.

Other material.—One specimen from G-974, 24°22′N, 80°57′W, SE of Sombrero Light, Florida Keys, 251–252 m, 3 February 1968,10′ OT, UMML 30-7697; this specimen is in poor condition but is here considered this species.

Geographic and bathymetric distribution.—See under Types.

Remarks.—This is one of the most striking of the species in the *S. lacunella-S. iris* complex.It can be distinguished readily from the others in this group by its finer, more numerous spiral cords, more numerous intraumbilical cords, striking coloration, and larger size. The 2 records of this species indicate that it probably is widely distributed throughout the Caribbean area, and may be present in other collections as *S. lacunella.*

Solariella (Solariella) tubula Dall, 1927
Figs. 65,66

Solariella tubula Dall, 1927a: 129.—Johnson, 1934: 72 (listed only).—Abbott, 1974: 41 (listed only).

Description.—Shell small (attaining about 4 mm in height), depressed-conical, whorls tubular and inflated, umbilicate, white, of about 3 whorls. Protoconch small, glassy, of about 1½ whorls. Spiral sculpture varies: the shell may be entirely smooth, it may be covered completely by spiral striations, or it may be somewhere in between; there is usually an umbilical keel, and the umbilicus often has a few spirals within; there may be a sharp or rounded subsutural ridge shouldering the whorl. Axial sculpture, when present, consists of numerous equal and equally spaced plications radiating from the suture, and is most distinct on the early whorls; on specimens with a sharp subsutural ridge, the axials finely serrate the ridge. Umbilicus rather wide and funicular. Aperture circular, lips thin and simple.

Syntypes.—USNM 108140, 154 specimens from ALBATROSS sta. 2668.

Type-locality.—ALBATROSS sta. 2668, 30°58′30″N, 79°38′30″W, 538 m, 5 May 1886, large beam trawl.

Material examined.—ALBATROSS sta. 2668; 154, USNM 108140 (syntypes); 5, USNM 108134.—ALBATROSS sta. 2415; 27, USNM 108422.—ALBATROSS sta. 2644; 1, USNM 330533.

Geographic distribution.—Known only from off southern Georgia and the Straits of Florida off Miami.

Bathymetric range.—353 to 805 m.

Remarks.—This is the smallest species of *Solariella* in the Straits area and probably in the Western Atlantic. Its small size probably accounts for its seeming rarity since it would generally pass through the mesh of most sampling gear other than a dredge, and if taken might easily be overlooked in the debris. It is a rather variable species, but can be mistaken for no other species of *Solariella* in the Western Atlantic.

Solariella (Solariella) lamellosa
(Verrill & Smith, 1880)
Figs. 61,62

Margarita lamellosa Verrill & Smith, 1880: 391, 397.—Verrill, 1880: 378; 1882: 530, pl. 57, fig. 38.—Watson, 1886: 82.
Margarita aegleis: Dall, 1881: 40 *(partim)*.
Margarita (Solariella) lamellosa: Dall, 1889a: 379; 1889b: 164, pl. 63, fig. 98 (list only; figure from Verrill, 1882).—Pilsbry, 1889: 315, pl. 57, fig. 14 (description from Verrill & Smith, 1880; figure from Verrill, 1882).
Margarita (Solariella) amabilis: Dall, 1889a: 378 (*partim*); 1889b: 164 (*partim*; listed only).
Solariella calatha: Dall 1927a: 128 (*partim*).
Solariella tiara: Dall, 1927a: 130.
Solariella lamellosa: Johnson, 1934: 71 (listed only).
Solariella (Machaeroplax) lamellosa: Abbott, 1974: 40, fig. 275.

Description.—Shell attaining a height of about 9 mm, thin, bluntly conical, carinate, umbilicate, of 6 to 7 whorls. Protoconch small, glassy, slightly depressed, of about 1 whorl. There are 2 spiral carinae on the spire with a 3rd appearing on the body whorl; the subsutural carina bears strong, rounded tubercles and tabulates the whorl; the 2nd carina is just below mid-whorl, and forms the periphery; the 3rd carina, on which the suture is formed, defines the base; a row of strong tubercles circumscribes the umbilicus; there may or may not be fine spiral threads in the spaces between the carinae and within the umbilicus. Axial sculpture of thin ribs on the first 2 whorls, becoming obsolete thereafter, remaining only as tubercles on the upper 2 carinae; shell otherwise with fine growth lines. Base flattened, smooth or spirally striate; umbilicus wide, deep, and somewhat restricted within. Aperture subcircular, angulated by the carinae; lips thin and simple; columella concave, not thickened.

Holotype.—USNM cat. no. 44738, from ALBATROSS sta. 871.

Type-locality.—ALBATROSS sta. 871, off Martha's Vineyard, 210 m.

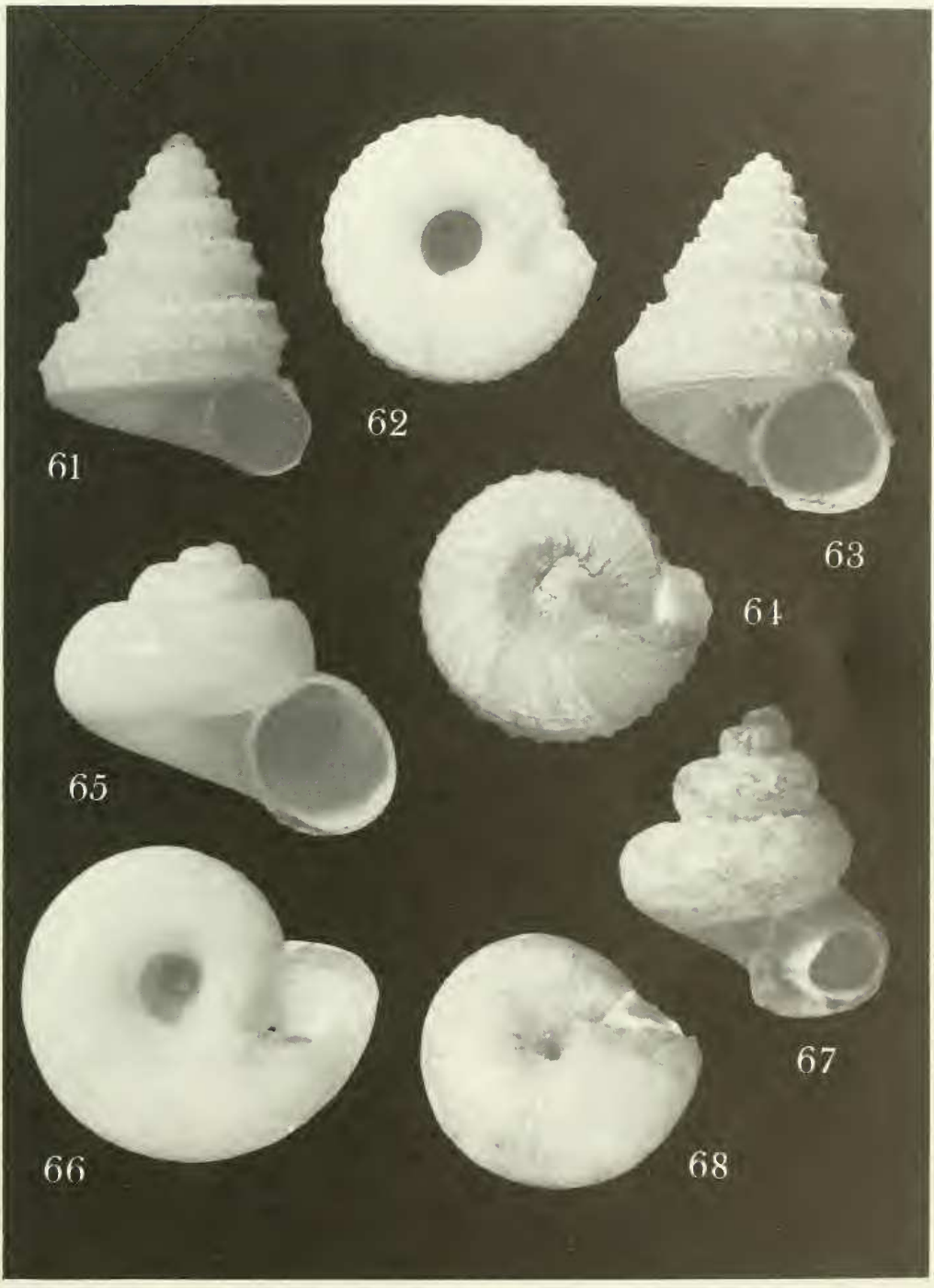
Material examined.—Straits of Florida: G-300; 2, UMML 30-8051.—G-4; 1, UMML 30-8025.—G-830; 1, UMML 30-7565.—ALBATROSS sta. 2644; 7, USNM 94946; 4, USNM 330559.—G-23; 2, UMML 30-8099.—EOLIS sta. 115, off Government Cut, 183 m; 1, USNM 438406.—EOLIS sta. off Fowey Rocks: 153; 1, *ex* USNM 438352.—303; 11, USNM 438431.—305; 4, USNM 438434.—306; 10, USNM 438435.—340; 14, USNM 438438.—348; 2, USNM 438437.—349; 2, USNM 438439.—360, 14, *ex* USNM 438349.—361; 100, USNM 438444.—377; 12, USNM 438451.—378; 5, USNM 438456.—EOLIS sta. 368, off Ajax Reef, 146–185 m; 5, USNM 438459.—EOLIS sta. 339, off Ragged Key, 183 m; 7, USNM 438400.—G-857; 2, UMML 30-8042.—G-834; 1, UMML 30-7538.—G-1035; 1, UMML 30-7914.—G-970; 8, UMML 30-7770.—G-969; 1, UMML 30-8063.—G-968; 1, UMML 30-7644.—G-967; 6, UMML 30-8062.—G-1099; 1, UMML 30-8065.—G-861; 1, UMML 30-8058.—EOLIS sta. 302; 1, USNM 438416.—EOLIS sta. 323; 19, USNM 438415.—Schmitt sta. 69 off Dry Tortugas, 455–655 m; 5, USNM 421840.—BLAKE sta. 2; 4, USNM 94947.—BLAKE sta. 21; 4, USNM 94948.

Geographic distribution.—From off North Carolina south through the Straits of Florida, and the Antillean Arc to Barbados.

Bathymetric range.—Living examples of the species have been taken from 25 to 600 m, and dead specimens are known down to 1472 m.

Remarks.—This species has had a rather confused history, primarily as a result of Dall's work. At first Dall assigned specimens of *S. lamellosa* and *S. pourtalesi* Clench & Aguayo to *Calliotropis aeglees* (Watson) (Dall, 1881). In 1889 he separated these 2 species from *C. aeglees*, regarding *S. lamellosa* as a distinct species. He did not consistently recognize *S. lamellosa*, especially young specimens, and placed some of these along with most of his specimens of *S. pourtalesi* with the Eastern Atlantic species *S. amabilis* (Jeffreys) (see also *S. pourtalesi* Clench & Aguayo). Juvenile specimens of *lamellosa* were also present in lots reported by Dall (1927a) as *S. calatha,* and, in the same paper, he listed a specimen of *lamellosa* as *S. tiara* (Watson). Clench & Aguayo (1939) finally separated *S. pourtalesi* as a distinct species, but did not recognize that some of the USNM lots of *pourtalesi* were mixed, containing *lamellosa* as well.

S. lamellosa is very closely related to *S. amabilis* and *S. pourtalesi. S. lamellosa* presents a neater appearance than either *amabilis* or *pourtalesi* since the sculpture is sharper and the shell is more acutely angulated. The umbilicus is also wider in *lamellosa* than in the other 2 species, making the base very narrow. *S. lamellosa* is one of the commonest species in the Straits area in depths



FIGS. 61–68. 61–62. *Solariella (Solariella) lamellosa* (Verrill & Smith): G-967, h = 8.3 mm, d = 7.0 mm. 63–64. *Solariella (Solariella) pourtalesi* Clench & Aguayo: P-747, h = 9.1 mm, d = 7.6 mm. 65–66. *Solariella (Solariella) tubula* (Dall) (syntype): ALBATROSS-2668, h = 3.7 mm, d = 4.7 mm. 67–68. *Solariella (Micropiliscus) constricta* Dall (syntype): ALBATROSS-2145, h = 3.6 mm, d = 3.1 mm.

greater than 200 m, but is primarily an inhabitant of depths of 50 to 150 m throughout its range.

Solariella (Solariella) pourtalesi
Clench & Aguayo, 1939
Figs. 63,64

Margarita (Solariella) amabilis: Dall, 1889a: 378 (*partim*); 1889b: 164 (*partim*; listed only).—Pilsbry, 1889: 313 (*partim*) (*non Trochus amabilis* Jeffreys, 1865.)
Solariella pourtalesi Clench & Aguayo, 1939: 190, pl. 28, fig. 2.—Abbott, 1974: 41.

Description.—Shell large for the genus, reaching height of 10.3 mm, rather thin, bluntly conical, carinate, umbilicate, of about 6½ whorls. Nucleus small, inflated, glassy, of about 1½ whorls. Spiral sculpture of 2 pustulose carinae, 1 just below the suture, shouldering the whorl, and the other about midwhorl, forming the periphery; a 3rd carina, on which the suture is formed, is thread-like, smoothish, and circumscribes the base; fine spiral threads may be present in the intercarinal spaces and on the base; a strongly tuberculate cord borders the rather wide, funicular umbilicus. Axial sculpture of lamellar ribs on the second and third whorls and prominent, irregular growth lines. Aperture subcircular; lips thin, simple, inner lip slightly flared over the umbilicus; columella arched, not thickened.

Holotype.—MCZ 135108, from ATLANTIS sta. 2993.

Type-locality.—ATLANTIS sta. 2993, 23°24′N, 80°44′W, 1061 m, 15 March, 1938, 14′ Blake trawl.

Material examined.—G-693; 20, UMML 30-8053.—G-366; 3, UMML 30-8053.—G-365; 2, UMML 30-8052.—G-1107; 1, UMML 30-8139.—G-1106; 2, UMML 30-8046.—G-368; 1, UMML 30-8092.—G-446; 1, UMML 30-8140.—G-375; 2, UMML 30-8056.—G-859; 1, UMML 30-8141.—G-374; 4, UMML 30-8055.—G-128; 1, UMML 30-8142.—G-129; 6, UMML 30-8048.—G-964; 1, UMML 30-7744; 2, UMML 30-8061.—G-965; 11, UMML 30-7760.—G-1112; 2, UMML 30-8066.—G-960; 18, UMML 30-8060.—G-959; 1, UMML 30-8059.—BLAKE sta. 2; 2, USNM 94947.—Off Havana, 1873 m, Henderson coll.; 1, USNM 438225.—BLAKE, sta. no. unrecorded, Yucatan Channel, 1170 m; 3, USNM 168774.

Geographic distribution.—From the Northwest Providence Channel south through the Straits of Florida and the Yucatan Channel, and southeast through the Lesser Antilles.

Bathymetric range.—This species occurs in deep water from 275 to 2350 m.

Remarks.—This is a rather common species in depths greater than 1000 m. In the northern Straits the species occurs in somewhat shallower depths, about 650–1000 m, but the record of 275–293 m (G-693) seems suspect. The station data seem to be correct, so perhaps the specimens were mislabeled. Dall originally identified the species as *S. amabilis* (Jeffreys) (see also *S. lamellosa* (Verrill & Smith) referring to a rather overdrawn illustration of *amabilis* in Jeffrey's work. He also identified 1 specimen as *Calliotropis rhina* (Watson). Clench & Aguayo (1939), in working up the ATLANTIS material, finally recognized *pourtalesi* as a separate species. Even though *pourtalesi* is superficially rather similar to *C. rhina,* it seems most closely allied to *S. lamellosa (q. v.),* differing in being larger, more coarsely sculptured, and with a relatively narrow umbilicus.

Subgenus **Suavotrochus** Dall, 1924

Suavotrochus Dall, 1924: 90.

Type-species.—Solariella lubrica, Dall, 1881; by monotypy.

Diagnosis.—Shell small, iridescent, smooth or nearly so, umbilicate.

Solariella (Suavotrochus) lubrica
(Dall, 1881)
Figs. 68–74.

Margarita lubrica Dall, 1881: 44.
Margarita (Solariella) lubrica: Dall, 1889a: 392, pl. 21, figs. 9, 9a; 1889b: 164, pl. 21, figs. 9, 9a (listed only; figs. from 1889a).—Pilsbry, 1889: 324, pl. 51, figs. 25, 26 (description from Dall, 1881; figs. from Dall, 1889a).
Margarita (Solariella) lubrica var. *iridea* Dall, 1889a: 382; 1889b: 164 (listed only).—Pilsbry, 1889: 324 (from Dall, 1889a).
Solariella (Suavotrochus) lubrica: Dall, 1924: 90.
Solariella (Machaeroplax) lubrica lubrica: Johnson, 1934: 72 (listed only).
Solariella (Machaeroplax) lubrica iridea: Johnson, 1934: 72 (listed only).
Solariella (Solariella) lubrica lubrica: Abbott, 1974: 41, fig. 290 (listed only; fig. from Dall, 1889a).

Solariella (Suavotrochus) lubrica iridea: Abbott, 1974: 41, fig. 290a.

Description.—Shell small (reaching a height of 5.5 mm), bluntly conical, smooth, brilliantly nacreous when fresh, otherwise white, of about 5 whorls. Nucleus small, glassy, with very fine spiral striations, of about 1–1¼ whorls. Whorls inflated, smooth, with a strong subsutural ridge which breaks up into elongate beads on the last 2 or 3 whorls; the beads are crossed by 2 fine spiral threads, giving the beads a squarish cross-section. Whorl rounds smoothly into the base, at the center of which is a moderate, funicular umbilicus. A ridge composed of 1 or 2 spiral threads encircles the umbilicus in most specimens; ridge beaded by strong axial plications which originate within the umbilicus and extend a short distance onto the base. Aperture circular; lips thin and simple; inner lip slightly flared over the umbilicus. Operculum thin, corneous, multispiral.

Holotype.—USNM 95061, from BLAKE sta. 2.

Type-locality.—BLAKE sta. 2, 23°14′N, 82°25′W, 1472 m.

Material examined.—ALBATROSS sta. 2644;1, USNM 95063; 1, USNM 95063a; 2, USNM 330549.—EOLIS sta. off Fowey Rocks: 346; 238 m; 1, USNM 450491.—347, 220 m; 2, USNM 438292.—348; 201 m; 2, USNM 450490.—349, 183–274 m; 1, USNM 450493.—EOLIS sta. 372, 183 m; 1, USNM 450503.—EOLIS sta, 339, off Ragged Key, 183 m; 1, USNM 438289; 1, USNM 450554. —G-1095; 6, UMML 30-7931.—G-1096; 5, UMML 30-8088.—G-967; 2, UMML 30-8086. —Schmitt sta. 69 off Tortugas, 455–655 m; 1, USNM 421842.—BLAKE sta. 2; 1, USNM 95061 (holotype).

Geographic distribution.—From the Straits of Florida off Miami, south throughout the Caribbean, and the Gulf of Mexico.

Bathymetric range.—From 155 to 1472 m. *S. lubrica* probably inhabits depths of about 200 to 500 m.

Remarks.—This species is somewhat variable in the strength of its sculpture. Dall (1889a) described the variety *iridea* from off Cape Florida for a form which is somewhat more inflated than the typical form, and is almost devoid of all sculpture. However, other specimens from the same locality show intergrades which indicate that this variety is nothing more than a morphological variant. The occurrence of *S. lubrica* at BLAKE sta. 2 (1472 m) is probably not indicative of a normal existence at that depth. As with other species recorded from that station, *S. lubrica* probably lives in considerably shallower water and was moved down the steep slope of the northern Cuban coast after death.

Subgenus **Micropiliscus** Dall, 1927

Micropiliscus Dall, 1927a: 130.

Type-species.—*Solariella (Micropiliscus) constricta* Dall, 1927; by monotypy.

Diagnosis.—Shell small, spirally striate, umbilicate, with a large brown carinate protoconch.

Solariella (Micropiliscus) constricta Dall, 1927
Figs. 67,68

Solariella (Micropiliscus) constricta Dall, 1927a: 130.

Description.—Shell small (reaching a height of about 4 mm), turbinate, umbilicate, of about 3 whorls. Protoconch large, conical, brown, smooth with 1 or 2 spiral carinae just above the suture, of about 2 whorls; there is a sharp, flaring varix separating the protoconch and teleoconch. Spiral sculpture of fine, weak, subequal spiral threads over the whole surface of the shell. Axial sculpture of fine growth lines; some specimens have a series of small, axially elongated pits radiating out from the suture, giving the whorl a puckered aspect. Base rounded, not set off from the rest of the whorl; umbilicus small and pore-like, without a carina. Aperture subcircular; lips thin and simple.

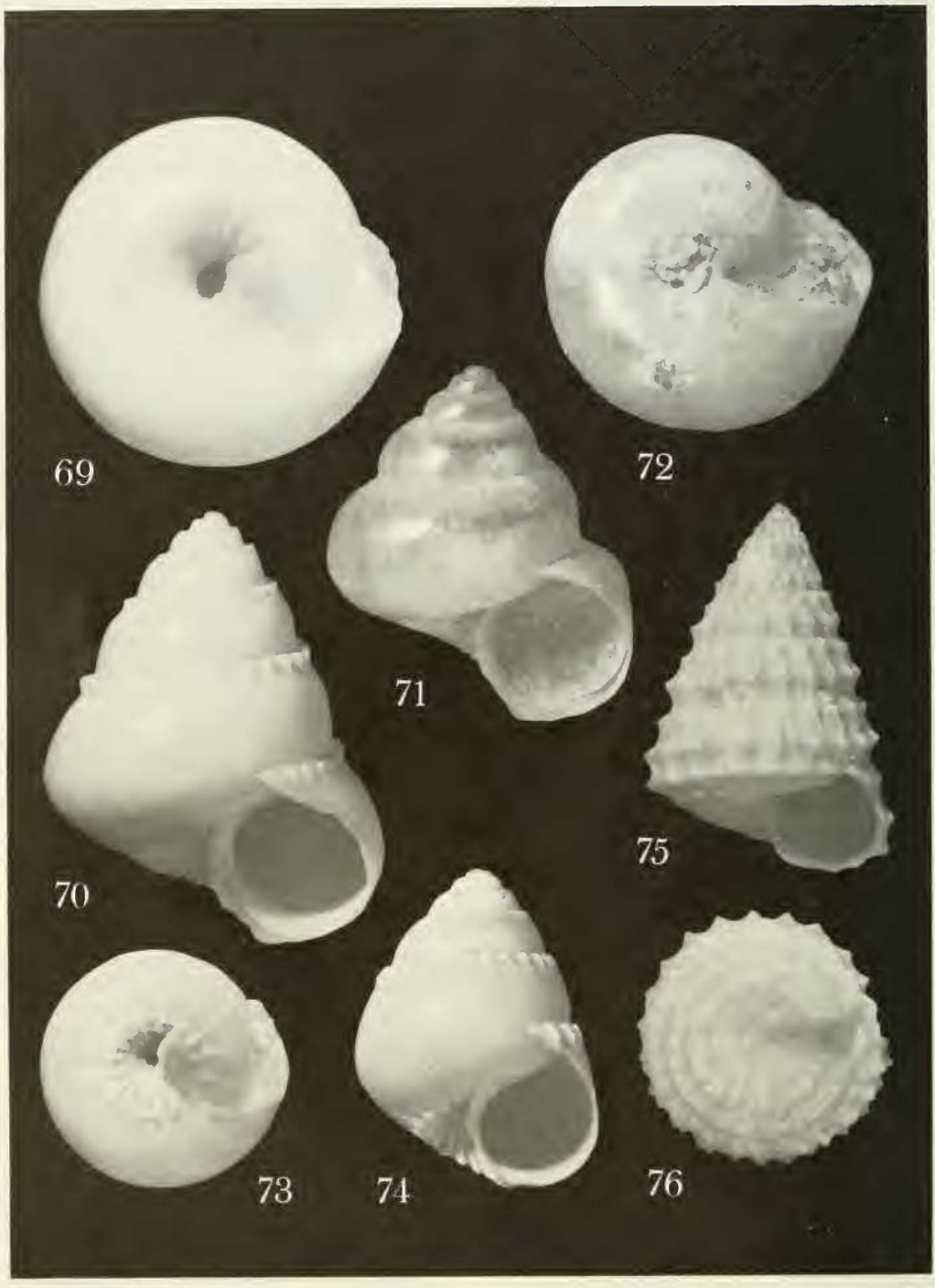
Syntypes.—A series of 11 specimens in 2 lots is in the USNM, cat. nos. 108414a and 108414b, from ALBATROSS sta. 2415.

Type-locality.—ALBATROSS sta. 2415, 30°44′N, 79°26′W, 805 m, 1 April 1885, large beam trawl.

Material examined.—ALBATROSS sta. 2415; 5, USNM 108414a; 6, USNM 108414b (syntypes).—EOLIS sta. 370, off Ajax Reef, 128–165 m; 2, USNM 450572.—EOLIS sta. 344, off Key West, 183 m; 1, USNM 450536. —EOLIS sta. 338, off Sand Key, 156 m; 1, USNM 450526.

Geographic distribution.—This species is known only from off southern Georgia and the Straits of Florida off Miami and Key West.

Bathymetric range.—Known from 128–164 to 805 m.



FIGS. 69–76. 69–70. *Solariella (Suavotrochus) lubrica* (Dall): G-1089, h = 5.5 mm, d = 4.6 mm. 71–72. *Solariella (Suavotrochus) lubrica* (Dall) ("var. *iridea*" Dall, holotype): ALBATROSS-2644, h = 5.2 mm, d = 4.8 mm. 73–74. *Solariella (Suavotrochus) lubrica* (Dall) (holotype): BLAKE-2, h = 4.7 mm, d = 4.0 mm. 75–76. *"Solariella" tiara* (Watson): G-289, h = 6.6 mm, d = 4.7 mm.

Remarks.—*S. constricta* is a very distinctive species since it is the only species in the group which has a large brown protoconch. The shell ornamentation varies only slightly in that the spiral striations are often slightly stronger at the whorl periphery and the subsutural pits may or may not be present.

Solariella species *incertae sedis*

"Solariella" tiara (Watson, 1879)
Figs. 75,76

Trochus (Ziziphinus) tiara Watson, 1879: 696; 1886: 60, pl. 6, fig. 4.
Calliostoma tiara: Dall, 1880: 45; 1881: 45 (*partim*); 1889a: 365; 1889b: 162 (listed only).—Pilsbry, 1889: 380, pl. 17, fig. 29.—Johnson, 1934: 70 (listed only).
Margarita scabriuscula Dall, 1881: 41.
Margarita (Solariella) scabriuscula: Dall, 1889a: 379, pl. 21, figs. 10, 10a; 1889b: 164, pl. 21, figs. 10, 10a (listed only; figs. from 1889a).—Pilsbry, 1889; 330, pl. 51, figs. 28, 29 (description from Dall, 1881; figs. from Dall, 1889a).
Solariella scabriuscula: Johnson, 1934: 71 (listed only).—Abbott, 1974: 41, fig. 280 (listed only; fig. from Dall, 1889a).
Solariella (Machaeroplax) tiara: Johnson, 1934: 72 (listed only).
Solariella tiara: Clench & Turner, 1960: 78 (major synonymy only).—Abbott, 1974: 41 (listed only).

Description.—Shell small, thin, spire rounded conical, of 6 to 7 whorls. Protoconch bulbous, glassy, of 1 whorl. Spiral sculpture of, on the spire 2, on the last whorl 3 carinae, each set with numerous strong, conical tubercles. The upper carina is separated from the suture by a narrow flat area and is on the same level as the suture, the second is just below mid-whorl and forms the periphery, and the third, on which the suture forms, defines the base, Base with 3 to 4 spiral cords whose sculpture ranges from weakly undulate to fairly distinctly beaded; the innermost cord is strongly beaded and bounds the umbilical depression. Axial sculpture of sharp riblets on the first 2 whorls persisting on later whorls as low ridges between the carinae, irregularly connecting tubercles on adjacent carinae. Otherwise, there are fine, crowded, irregular growth lines over the whole surface. Base flatly rounded, with a shallow central depression, at the center of which is a small umbilical pore which is reduced to a chink in most specimens. Aperture subrectangular, slightly thickened within; lips thin, inner lip slightly reflected; columella thickened, sometimes more so in the middle, forming an obscure tooth.

Syntypes.—Series of three specimens is in the British Museum (Natural History), cat. nos. 87.2.9.218-220, from CHALLENGER sta. 56.

Type-locality.—CHALLENGER sta. 56, off Bermuda, 32°04′45″N, 64°59′35″W, in 1966 m.

Material examined.—G-23; 1, UMML 30-8098.—G-815; 1, UMML 30-8143.—G-289; 1, UMML 30-8050.—G-966; 1, UMML 30-8094.—Gulf of Mexico: BLAKE sta. 44; 1, USNM 214281 (holotype of *Margarita scabriuscula*).

Geographic distribution.—Known from Bermuda, the Straits of Florida, the Gulf of Mexico, and the Caribbean, especially the Antilles.

Bathymetric range.—This species has been taken in depths of 400–1966 m. It seems to be most frequent in the 600–800 m range.

Remarks.—As can be seen in the synonymy, this species has been cited frequently since its description. However, no one has compared specimens of *tiara* with the holotype of *scabriuscula,* the only known specimen of that species. Instead, authors subsequent to Dall merely quoted from the literature. In trying to identify specimens from the Straits, I examined the holotype of *scabriuscula* and compared it with a photograph of one of the syntypes of *tiara*; I found no characters on which to base a separation at the specific level. A subsequent examination of specimens taken by the PILLSBURY from the Caribbean supported my belief that the two species are in fact the same. This species has been placed in the genus *Solariella* by most authors since Dall, but in my opinion, it does not belong there at all. I can find no described group in which *tiara* fits, and so assign it to a "genus uncertain" rank.

Genus **Microgaza** Dall, 1881

Microgaza Dall, 1881: 50; 1889a: 357; 1889b: 160.—Dall, in Guppy & Dall, 1896: 323.—Pilsbry, 1889: 11, 160.—Cossmann, 1918: 258.—Woodring, 1928: 435.—Johnson, 1934: 74.—Thiele, 1929: 48.—Keen, 1960: I262.—Abbott, 1974: 42.

Type-species.—*Callogaza (Microgaza) rotella* Dall, 1881: 51; by monotypy.

Diagnosis.—Shell small, circular, depressed, deeply umbilicate, highly iridescent

when fresh. Aperture subquadrate, lips thin, columella straight and simple. Sculpture of umbilical plications extending out onto the base and sometimes pustulations or plications at the suture. Operculum thin, corneous, circular, multispiral.

Remarks.—*Microgaza* was introduced as a subgenus of *Callogaza* Dall, 1881, for *M. rotella* Dall, 1881. In 1889 he relegated *Callogaza* to subgeneric rank under *Gaza* Watson, 1879, and kept *Microgaza* as a subgenus, placing it in *Gaza.* The first usage of *Microgaza* at the generic level was by Dall (1885) in his list of eastern American molluscs. Cossmann (1918) described a fossil species from the European Miocene as *Microgaza*, but Woodring (1928) expressed doubt that it was actually in this genus. Woodring in the same paper described a new subspecies of *rotella, vetula*, and erected a new subgenus to accommodate his *M. cossmanni. M. cossmanni* is fossil and *vetula* was first reported as a fossil, but the GERDA has obtained 6 specimens of *vetula* to bring the total number of living forms known to 3 (including 1 subspecies).

The systematic position of *Microgaza* has long been unsettled. Dall's original placement of *Microgaza* in *Callogaza* and then *Gaza* was followed in turn by Cossmann (1918), who included it under *Eumargarita* Fischer, 1885 (=*Margarites* Gray, 1847), Thiele (1929), who synonymized it with *Solariella* Wood, 1842, and Keen (1960), who placed it as a subgenus of *Solariella.* Examination of the radula of *Microgaza rotella rotella* indicates a close relationship with *Solariella.* The radular ribbon is rather short and broad with relatively few rows of teeth. The rhachidian is broad and rounded posteriorly with a very strong cusp bearing two denticles on each side. The admedians and second laterals are similar to each other, each with an inwardly directed triangular cusp, denticulate only on the outer edge. The third lateral is very strong and broad with a rather weak, inwardly directed cusp. The few marginals (6–8 per half-row) are large and sickle-shaped, overhanging the three laterals. Radular formula is 8-6.3.1.3.6-8 (see figure below).

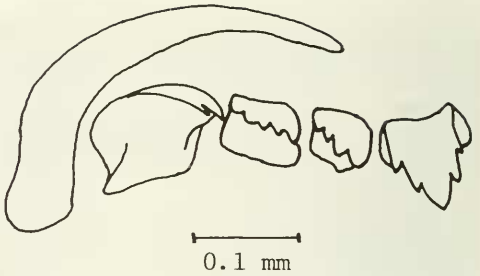


FIG. 90. Part of a half-row of the radula of *Microgaza rotella rotella* showing the rhachidian, the three laterals and the inner marginal.

Microgaza rotella rotella (Dall, 1881)
Figs. 77,78

Callogaza (Microgaza) rotella Dall, 1881: 51.
Microgaza rotella: Dall, 1885: 170; 1889b: 160, pl. 22, figs. 5, 5a (listed only).—Dall, in Guppy & Dall, 1896: 323.—Woodring, 1928: 435.—Abbott, 1974: 42.
Gaza (Microgaza) rotella: Dall, 1889a: 357, pl. 22, figs. 5, 5a.—Pilsbry, 1889: 160, pl. 48, figs. 5, 6 (description from Dall, 1881; figs. from Dall, 1889a).—Johnson, 1934: 74 (*partim*; listed only). Dautzenberg, 1900: 71.

Description.—"Shell depressed, with five whorls, somewhat flattened above and below; nucleus small, translucent white, and with the two first whorls smooth or marked only by faint growth-lines; remainder of the whorls with a narrow puckered band revolving immediately below the suture, on which the shell matter is as if it were pinched up into slight elevations at regular intervals, about half a millimeter apart. In some specimens, outside of this band an impressed line revolves with the shell; remainder smooth, shining or with evanescent traces of revolving lines impressed from within and strongest about the rounded periphery; base rounded toward the umbilical carina over which it seems to be drawn into flexuously radiating well-marked plications (about thirty-two on the last turn) which disappear a third of the way toward the periphery; walls of the umbilicus concave, overhung by the carina, turns of the shell so coiled that the part of each whorl uncovered by its successor forms a narrow spiral plane ascending to the apex like a spiral staircase or screw thread. Pillar straight, thin, with no callus; aperture rounded except at the angle of the umbilical carina; margin thin, sharp, not reflected or thickened; no callus on the body whorl in the aperture; shell whitish or greenish; nacre less brilliant in dead or deep-water specimens; with zigzag brown lines variously transversely disposed and disappearing on the base." (Dall, 1881.)

Lectotype.—MCZ 7548, from BLAKE sta. 2. The paralectotype from this station is MCZ 288095 and 7 more from Barbados are MCZ 7550.

Type-locality.—Here restricted, BLAKE sta. 2, 23°14′N, 82°25′W, in 1472 m.

Material examined.—Straits of Florida: G-606; 2, UMML 30-7418.—G-451; 1, UMML 30-8009.—G-1035; 4, UMML 30-7913.—EOLIS sta. 322, off Sand Key, 210 m; 2, USNM 437998.—EOLIS sta. 323, off Sand Key, 201 m; 1, USNM 437999.—EOLIS sta. 344, off Key West, 183 m; 1, USNM 438004.—EOLIS sta. 333, off Key West, 201 m; 3, USNM 438005.—EOLIS sta. C, S. of Key West, 183 m; 1, USNM 438007.—BLAKE sta. 2; 1 MCZ 7548 (lectotype) 1 MCZ 288095 (paralectotype).—Barbados: BLAKE sta., number unrecorded, 183 m; 7, MCZ 7550 (paralectotypes). Many lots from the EOLIS in shallower water in the Straits, and from the SUI expedition to Barbados.

Geographic distribution.—The southeastern Gulf of Mexico, the Straits of Florida occasionally as far north as Key Largo, Cuba and south through the Antillean arc.

Bathymetric range.—The possible range is 46 to 1472 m, but most commonly occurring in 100 to 200 m.

Remarks.—This is a beautiful species occurring rather commonly in depths less than 200 m. *Microgaza rotella rotella* is the southern form of this species, occurring occasionally as far north as Key Largo. The area from roughly Key Largo to off Miami is the transitional area between the 2 subspecies, with intermediate forms occurring commonly. North of Miami the subspecies *inornata* is found exclusively, and south of Key Largo only true *rotella* is taken. This indicates that true geographic subspecies are involved and not mere individual or population variation. The distinguishing character of true *rotella* is the presence of a row of elongate beads just below the suture line. The other subspecies, *inornata,* lacks these pustules; however, the name *"inornata"* seems never to have been introduced validly into the literature. I herein do so:

Microgaza rotella inornata
Quinn, n. subsp.
Figs. 74,80

Microgaza rotella: Dall, 1889a: 357 (*partim*); 1889b: 160 (*partim*); listed only).—Pilsbry, 1889: 160 (*partim*).

Microgaza rotella inornata Dall, in Guppy & Dall, 1896: 323.—Woodring, 1928: 435. Both are *nomina nuda.*

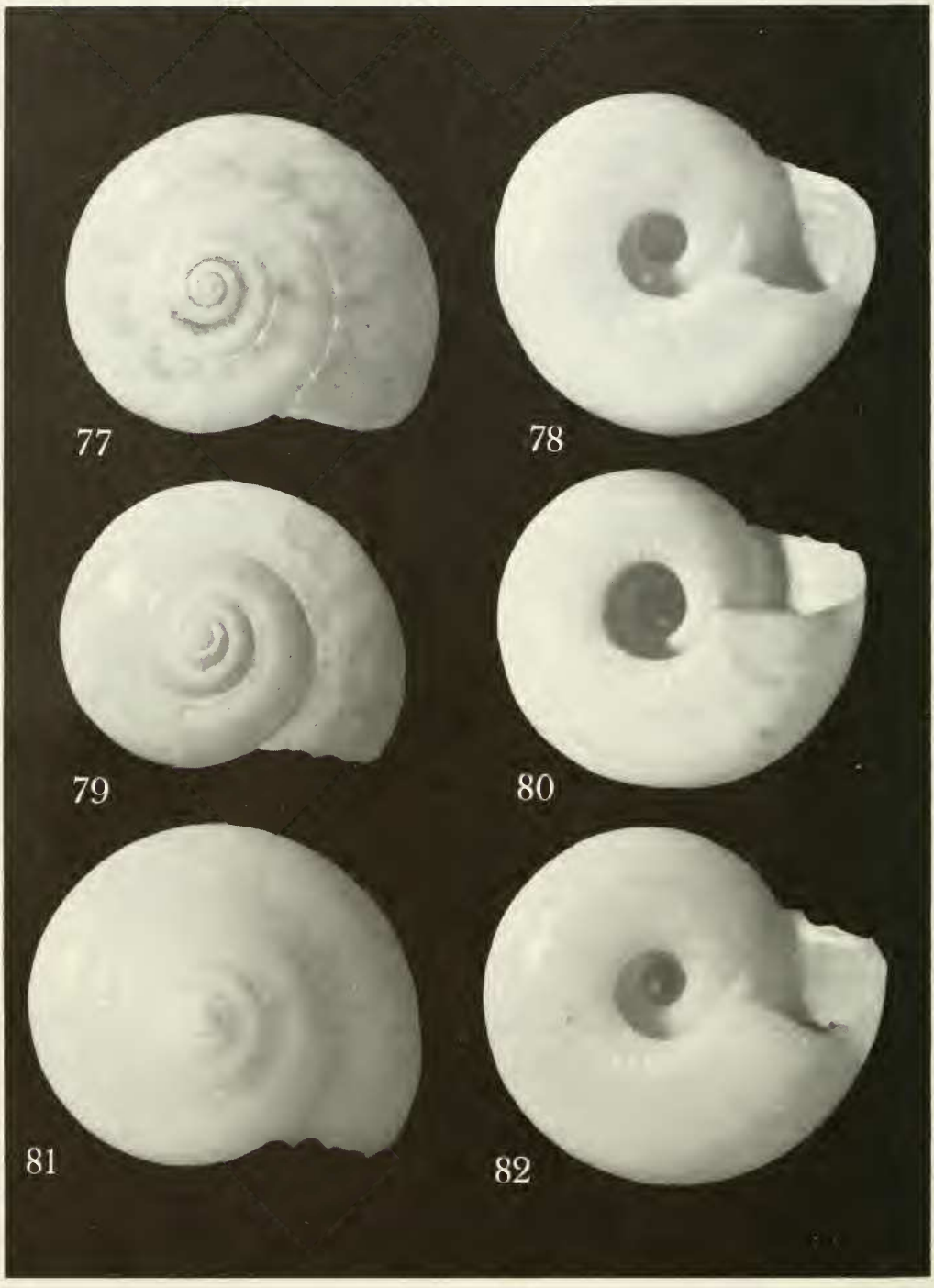
Microgaza rotella form *inornata*: Abbott, 1974: 42 (name invalid under Article 45e (ii), International Code of Zoological Nomenclature, 1964).

Holotype.—USNM 94101, from ALBATROSS sta. 2311.

Type-locality.—ALBATROSS sta. 2311, 32°55′N, 77°54′W, off South Carolina, in 144 m.

Description.—Shell depressed, whitish with irregular zigzag splotches of brown on the upper surface of the whorls, highly iridescent, of about 5 whorls. Nucleus small, white, polished, of 1½ whorls. Post-nuclear whorls with faint spiral lines near the periphery. A series of radial grooves around the umbilicus crenulates the umbilical keel. Occasional specimens may have a fine smooth cord just beneath the suture on the third and fourth whorls, but most specimens lack this character. Umbilicus wide, deep, with slightly concave walls, giving the umbilicus the aspect of a spiral ramp. Aperture subquadrate, outer lip thin, simple; columella straight, thin, not reflected, forming a sharp angle with the base.

Material examined.—ALBATROSS sta. 2602; 1, USNM 94993.—ALBATROSS sta. 2592; 1, USNM 329455.—ALBATROSS sta. 2417; 1, USNM 87574.—ALBATROSS sta, 2311; 1, USNM 94101 (holotype).—ALBATROSS sta. 2312; 2, USNM 93659.—ALBATROSS sta. 2313; 6, USNM 94126.—ALBATROSS sta. 2314; 1, USNM 322960.—Burry coll., 24 km E of Delray Beach, 503–549 m; 1, USNM 620314.—EOLIS sta. 189, E of Cape Florida, 122 m; 16, USNM 438009.—EOLIS stations off Fowey Rocks: 165, 143 m; 2, 438039.—169, 128 m; 11, 438038.—174, 106 m; 3, 438037.—181, 130 m; 1, 438036.—182, 137 m; 1, 438041.—183, 146 m; 5, 438040.—186, 124 m; 2, USNM 438016.—305, 201 m; 1, USNM 438021.—346, 238 m; 1, USNM 438020.—351, 165 m; 14, USNM 438019.—352, 165 m; 13+, USNM 438018.—353, 155 m; 3, USNM 438017.—354, 146 m; 30, USNM 438022.—355, 128 m; 12, USNM 438028.—356, 101 m; 32, USNM 438027.—358, 229 m; 1, USNM 438026.—360, 183 m; 2, USNM 438025.—361, 137–183 m; 44, USNM 438029.—362, 174 m; 20, USNM 438024.—363, 155 m; 1, USNM 438023.—364, 137–165 m; 24, USNM 438034.—373, 128–165 m; 27, USNM 438033.—374, 155 m; 18, USNM 438032.—



FIGS. 77–82. 77–78. *Microgaza rotella rotella* (Dall) (lectotype): BLAKE sta. off Havana, Cuba, h = 3.8 mm, d = 6.5 mm. 79–80. *Microgaza rotella inornata* Quinn, n. subsp.: G-280, h = 3.7 mm, d = 6.3 mm. 81–82. *Microgaza vetula* Woodring: G-984, h = 3.8 mm, d = 6.8 mm.

375, 137–165 m; 16, USNM 438031.—382, 128 m; 3, USNM 438030.—Sta. no unrecorded, 91 m; 2, USNM 438036.—EOLIS sta. off Ragged Key: 192, 137 m; 3, USNM 438015.—193, 146 m; 12, USNM 438011.—194, 155 m; 1, USNM 438010.—339, 183 m; 2, USNM 438014.—365, 137 m; 1, USNM 438013.—366, 137–165 m; 19+, USNM 438012.—350, off Triumph Reef, 128–165 m; 49, USNM 438044.—368, off Ajax Reef, 146–183 m; 2, USNM 438043.—369, depth unrecorded; 2, USNM 438047.—370, off Ajax Reef, 128–165 m; 4, USNM 438042.—376, off Caesar's Creek, 165 m; 19, USNM 438046.—G-857; 1, UMML 30-8012.—G-606; 2, UMML 30-8011.

Geographic distribution.—From Cape Hatteras, North Carolina, south to about Miami, Florida.

Bathymetric range.—The possible depth range of this form is 91 to 549 m, but the normal range is probably about 120 to 180 m.

Remarks.—See also *Remarks* section under *M. rotella rotella.* The name *"inornata"* has been used since 1896 when Dall first mentioned it. This appears to be a manuscript name for which Dall never published a diagnosis, description, or figure. As such the name stands as a *nomen nudum,* and, since no one has validated it since, merely listing the name, I have corrected the oversight. I have retained *"inornata"* since it is an appropriate name and it will serve nomenclatural stability best.

Microgaza vetula Woodring, 1928
Figs. 81,82

Microgaza rotella: Dall, in Guppy & Dall, 1896: 323 (*partim*); Dall, 1903: 1585 (*partim*).
Microgaza rotella var. *inornata* Dall, 1903: 1585 (*fide* Woodring, 1928; listed only).
Eumargarita (Microgaza) rotella Dall subsp.: Cossmann, 1918: 258, pl. 9, figs. 9, 10.
Microgaza (Microgaza) rotella vetula Woodring, 1928: 435, pl. 37, figs. 1–3.

Description.—Shell depressed, porcellaneous, white, of about 5 whorls. Nucleus small, white, of about 1 whorl. First postnuclear whorl microscopically spirally striate, 2nd whorl with a series of flexuous axial riblets. Sculpture on following whorls of a low spiral cord which bears low beads and adjoins the suture. Fine spiral threads are present on the periphery of the whorls. Base smooth except for a series of grooves radiating out from the umbilicus and crenulating the umbilical keel. Umbilicus deep, not extremely wide, margin sharp, walls sharply angled back from the margin, exposing part of the base of the preceding whorl. Umbilical wall bears one to three fine spiral threads. Aperture subquadrate, lips thin and simple; columella thin, straight, inclined, forming a sharp angle with the basal lip.

Holotype.—USNM 369570.

Type-locality.—Bowden Formation, Jamaica, Miocene.

Material examined.—Straits of Florida: G-984; 3, UMML 30-7798.—G-985; 1, UMML 30-7815.—G-986; 2, UMML 30-7831.

Geographic distribution.—Recent specimens known only from the Straits of Florida near the Cay Sal Bank; found as a fossil in the Miocene of Jamaica (Bowden Formation).

Bathymetric range.—From 119 to 192 m.

Remarks.—This is the first record of this species from the Recent fauna. It was evidently a common species during the Miocene of Jamaica, and was described from there as a subspecies of *M. rotella.* Superficially, *vetula* looks like a small bleached *rotella,* but the two may be distinguished easily by *vetula's* smaller size, presence of axial riblets on the second whorl, smaller umbilicus with its walls retreating from the margin more sharply than in *rotella,* and spiral threads on the umbilical walls of *vetula.* These characters are distinctive and consistent, so I feel justified in separating *vetula* and *rotella* at the specific level.

Genus **Basilissa** Watson, 1879

Basilissa Watson, 1879: 593; 1886: 96.—Dall, 1889a: 383.—Pilsbry, 1889: 15, 419.—Cotton, 1959: 189.—Keen, 1960: 250.—Bayer, 1971: 123.—Abbott, 1974: 39.

Type-species.—*Basilissa superba* Watson, 1879, by subsequent designation: Cossmann, 1888: 335.

Diagnosis.—Shell usually small, trochoid, deeply umbilicate, carinate, highly nacreous. Aperture subquadrate, lips thin; outer lip with a wide, fairly deep sinus near the suture, and another, narrower sinus near the periphery of the basal lip, resulting in a claw-like projection of the lip at the periphery. Operculum circular, thin, concave, multispiral.

Remarks.—This genus has traditionally been included in the Trochidae, and indeed, species of *Basilissa* bear a strong resemblance to some members of the family, par-

ticularly some of the Calliostomatinae. As noted by Dall (1889a) and Bayer (1971) the nacreous shells and peculiar sinuses in the outer lip of *Basilissa* are quite similar to those in *Seguenzia*. Bayer further stated: "*Seguenzia costulata* (*sic*, error for *S. carinata* Jeffreys) differs from *Basilissa* only in having a stronger columellar fold and more deeply sinuate lip, thus forming a transition between the genera as already noticed by Dall" (Bayer, 1971: 123). The radulae of *Basilissa* and *Seguenzia* as described by Thiele (1929) are very similar, again indicating a close relationship. Therefore, even though I am including *Basilissa* in this report on the Trochidae, I believe that it belongs in the family Seguenziidae with *Seguenzia* and *Thelyssa* Bayer, 1971.

Geographic distribution.—Probably cosmopolitan in tropical and temperate waters.

Bathymetric range.—Primarily a deep water genus, occurring in 200–2000 m, although records of *B. costulata* are of less than 100 m.

Subgenus **Basilissa** Watson, 1879

Type-species.—*Basilissa superba* Watson, 1879, by subsequent designation: Cossmann, 1888: 335.

Diagnosis.—Shell thin, finely sculptured, aperture not thickened.

Basilissa (Basilissa) alta Watson, 1879
Figs. 83,84

Basilissa alta Watson, 1879: 597; 1886: 100. —Dall, 1881: 48; 1889a: 384; 1889b: 164 (listed only).—Pilsbry, 1889: 419, pl. 36, fig. 5.—Johnson, 1934: 73 (listed only).—Bayer, 1971: 123, fig. 6, D-G; fig. 7.

Seguenzia delicatula Dall, 1881: 48.

Basilissa alta var. *oxytoma* Watson, 1886: 100, pl. 7, fig. 8e.—Pilsbry, 1889: 421, pl. 36, fig. 4.

Basilissa alta var. *delicatula*: Dall, 1889a: 384, pl. 22, figs. 2, 2a; 1889b: 164 (listed only).—Pilsbry, 1889: 421, pl. 48, figs. 3, 4.—Johnson, 1934: 73 (listed only).

Description.—See Watson, 1879 and 1886.

Holotype.—None selected. Syntypes are in the British Museum (Natural History), nos. 87.2.9.351 and 87.2.9.352, from CHALLENGER sta. 24.

Type-locality.—CHALLENGER sta. 24, off Culebra Island (Virgin Islands), 18°38′30″N, 65°05′30″W, in 713 m.

Material examined.—G-365; 1, UMML 30-8144.—G-370; 1, UMML 30-8145.—G-478; 1, 30-8146.—G-185; 1, UMML 30-8147.—BLAKE sta. 43; 1, USNM 94941.—G-959; 5, UMML 30-8148.—G-960; 7, UMML 30-8149.—G-963; 1, UMML 30-7692.—G-964; 1, UMML 30-8150; 2, UMML 30-7764.—G-965; 5, UMML 30-7759.—G-966; 1, UMML 30-8151.—G-967; 3, UMML 30-8152.—G-1099; 1, UMML 30-8018.—G-1112; 1, UMML 30-8022.

Geographic distribution.—Tongue of the Ocean, Bahamas, the Straits of Florida, the Gulf of Mexico, and south through the Antilles to Ceara, Brazil.

Bathymetric range.—Known from 348–1864 m, but occurs primarily in the 500–1500 m range.

Remarks.—This species exhibits a considerable variation in the strength of the surface sculpture of the shell. However, since this variation may be found in specimens of the same population, it is preferable to consider the varieties *oxytoma* and *delicatula* as infrasubspecific forms of *alta*.

Basilissa (Basilissa) discula (Dall, 1889)
Figs. 87,88

Fluxina discula Dall, 1889a: 273, pl. 23, figs. 5, 6; 1889b: 148, pl. 23, figs. 5, 6 (listed only).—Bayer, 1971: 129, fig. 8.

Planitrochus disculus: Abbott, 1974: 39 (listed only).

Description.—"Shell small, whitish, polished, of about five whorls, the base of the immersed nucleus looking exactly like a dextral nucleus; surface marked by the fine flexuous incremental lines, which do not interrupt the polish, and by faint occasional indications of spirals; upper surface of the whorls concave near the sutures, elsewhere flattened, so that the sutural junction is slightly elevated; periphery sharply carinated, base moderately rounded, not impressed near the carina; umbilicus moderate, scalar, its walls smooth and vertical; umbilical margin carinate, an impressed line just outside the carina; aperture wide, margins thin, columella straight, a little thickened, a wash of callus on the body; apparently little if any notch at the end of the umbilical carina." (Dall, 1889a: 274).

Holotype.—USNM 508721, from BLAKE sta. 180.

Type-locality.—BLAKE sta. 180, off Dominica, 15°29′18″N, 61°34′40″W, in 1796 m.

Material examined.—Bahamas: CI-356, 24°28.3′N, 77°29.5′W, 1597 m; 1, UMML 30-8157.—Straits of Florida: G-967; 1, UMML 30-8158.—G-1106; 1, UMML 30-8019.—G-960; 1, UMML 30-8159.—Lesser Antilles: BLAKE 180; 1, USNM 508721 (holotype).—P-604; 3, UMML 30-8160.

Remarks.—The considerable rarity of this beautiful species has no doubt led most workers to overlook it. Merrill (1970a), in synonymizing *Fluxina* with *Calliostoma* (see *Remarks* under *Callistoma brunneum*), did not even mention it, although he tentatively assigned *discula* to *Basilissa* in his dissertation (Merrill, 1970b). Bayer (1971) further discussed the similarities of the characters of *discula* and those of *Basilissa,* but declined to formally assign the species to *Basilissa* until more material was availble for study. Abbott (1974) placed *discula* in the extinct Silurian genus *Planitrochus* Perner, 1903. He was in error here since *Planitrochus* does not have the distinct sinuses in the outer lip which are evident in *discula.* For the present, then, I feel that *discula* best fits the characters of *Basilissa,* and until radular characters are known, I prefer keeping *discula* in *Basilissa.*

Basilissa (Basilissa) rhyssa Dall, 1927

Basilissa (Ancistrobasis) rhyssa Dall, 1927a: 121.—Johnson, 1934: 73 (listed only).
Basilissa rhyssa: Abbott, 1974: 38 (listed only).

Description.—Shell small, turbinate, strongly carinate, of about 6 whorls. Nucleus small, glassy, somewhat depressed. Whorls of spire with a single carina or shoulder about ⅓ down the whorl; body whorl periphery formed by an extremely acute, capelike carina which is hidden by the suture in the earlier whorls. Axial sculpture of low, flexuous ribs which modulate the whorl shoulder and extend down only as far as the peripheral carina. Base slightly convex and smooth except for very fine growth lines. Umbilicus moderate, bounded by a spiral cord. Aperture quadrangular, lips thin and with the typical *Basilissa* sinuses.

Syntypes.—Series of 3 specimens is in the USNM, cat. no. 108145, from ALBATROSS sta. 2668.

Type-locality.—ALBATROSS sta. 2668, off Fernandina, Florida, 30°58′30″N, 79°38′30″W, in 538 m.

Material examined.—ALBATROSS sta. 2415; 23, USNM 108395.—ALBATROSS sta. 2668; 3, USNM 108145 (syntypes).—BLAKE sta. 2; 2, USNM 214284.—BLAKE sta., Chicago Academy of Sciences, position unrecorded in the Yucatan Channel; 1, USNM 168769.

Geographic distribution.—From off southern Georgia south through the Straits of Florida to the Yucatan Channel.

Bathymetric range.—Known from 538–1472 m, but the true depth range for the species is problematical since all records are for dead shells. At least 1 station (BLAKE 2) had many rather shallow-water species which had obviously been transported down the steep slope of the northern Cuban escarpment.

Remarks.—This is a very distinctive species, the angulated whorls and capelike peripheral carina separating it immediately from all other known *Basilissa* species. Dall (1927) assigned *rhyssa* to the subgenus *Ancistrobasis* Dall, 1889, but that subgenus is characterized by a relatively heavy shell, with the aperture thickened and toothed within. *B. rhyssa* exhibits none of these characters and placement in *Ancistrobasis* seems unwarranted.

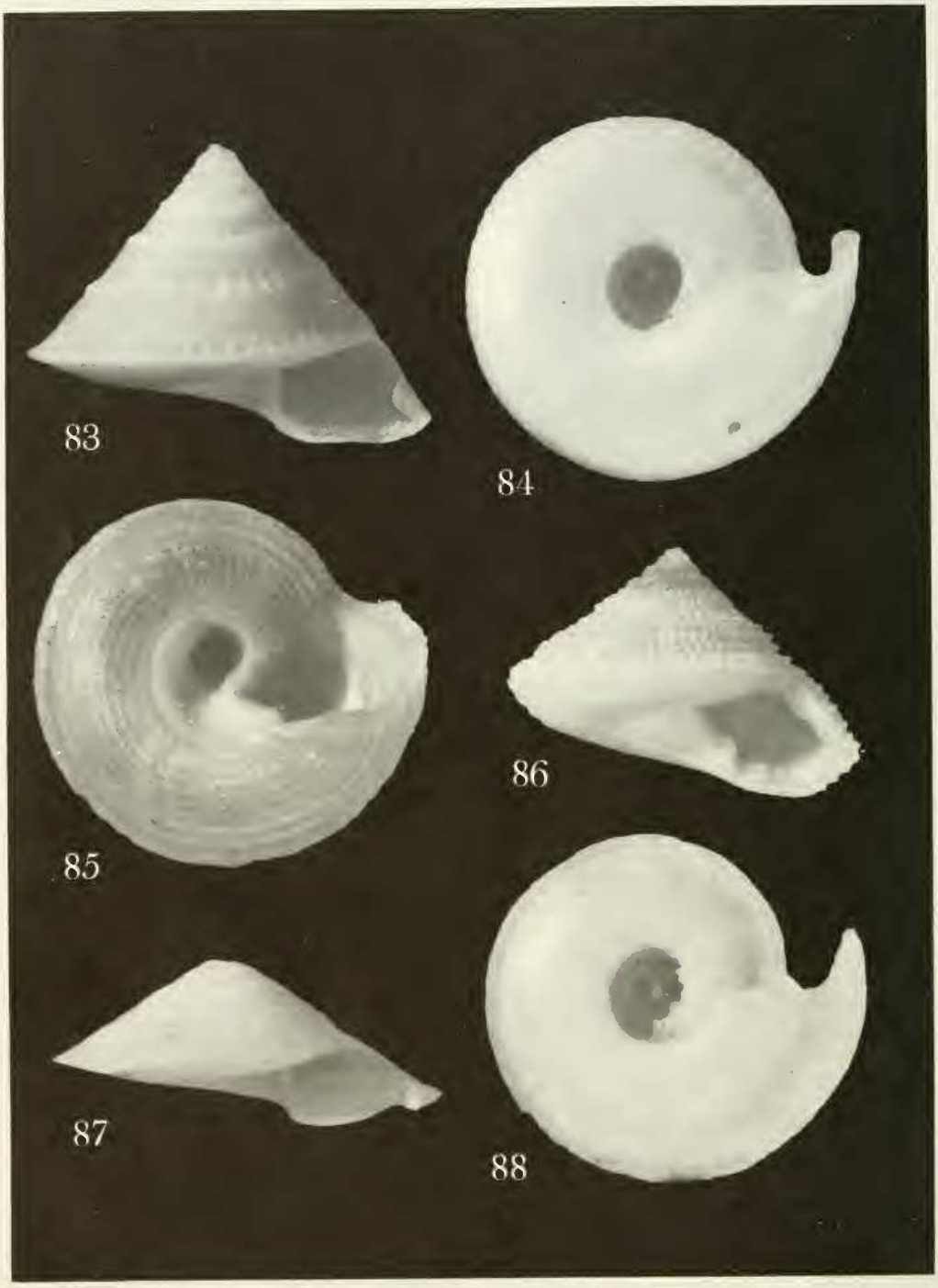
Subgenus **Ancistrobasis** Dall, 1889

Type-species.—*Basilissa costulata* Watson, 1879; by monotypy.

Diagnosis.—Shell solid, slightly depressed, highly sculptured; aperture thickened within and provided with strong lirations forming denticles at the aperture; columella with a strong terminal tooth.

Basilissa (Ancistrobasis) costulata
Watson, 1879
Figs. 85,86

Basilissa costulata Watson, 1879: 600; 1886: 103, pl. 7, fig. 11.—Dall, 1881: 48.
Basilissa (Ancistrobasis) costulata: Dall, 1889a: 384; 1889b: 164 (listed only).—Pilsbry, 1889: 426, pl. 36, fig. 3.—Johnson, 1934: 73 (listed only).—Abbott, 1974: 37 (listed only).
Basilissa (Ancistrobasis) costulata var. *depressa* Dall, 1889a: 384, pl. 23, figs. 4, 4a; 1889b): 164, pl. 23, figs. 4, 4a (listed only; figs. from 1889a).—Pilsbry, 1889: 428, pl. 60, figs. 14, 15 (description from Dall,



FIGS. 83–88. 83–84. *Basilissa (Basilissa) alta* Watson: CI-356, h = 4.7 mm, d = 6.1 mm. 85–86. *Basilissa (Ancistrobasis) costulata* Watson ("var. *depressa*"Dall): EOLIS-146, h = 4.2 mm, d = 6.1 mm. 87–88. *Basilissa (Basilissa) discula* (Dall): G-967, h = 2.9 mm, d = 6.6 mm.

1889a).—Johnson, 1934: 73 (listed only).—Abbott, 1974: 37.

Description.—See Watson, 1879; Dall, 1889a.

Holotype.—None selected. Syntype series of 3 immature specimens is in the British Museum (Natural History), cat. nos. 87.2.9.355-357, from CHALLENGER sta. 24.

Type-locality.—CHALLENGER sta. 24, off Culebra Island, Virgin Islands, 18°38′30″N, 65°05′30″W, in 713 m.

Material examined.—Straits of Florida: BLAKE sta. no. unrecorded, off Sand Key, in 27 m; 1, USNM 94945.—EOLIS sta. 146, off Key West, 179 m; 3, USNM 435753.—Yucatan Channel; BLAKE, sta. no. unrecorded, 1170 m; 3, USNM 94944.—G-897; 1, UMML 30-7717.

Geographic distribution.—From off southern Georgia through the Straits of Florida to the Yucatan Channel, the northern Gulf of Mexico, and the Virgin Islands.

Bathymetric range.—Recorded from 27–1170 m, establishing the species as the shallowest known species of the genera.

Remarks.—This is a very uncharacteristic species of *Basilissa.* Its heavy shell and strongly armed aperture, combined with its strong, coarse sculpture, make *costulata* a very easy species to recognize. There does not seem to be enough difference between *costulata s. s.* and *depressa* to warrant separation.

ZOOGEOGRAPHY

Faunal affinities.—From the study of a single family from so restricted an area as the Straits of Florida, it is somewhat dangerous to make broad generalizations or unqualified comparisons with the worldwide fauna. The results discussed herein are mostly indications, suggestive as they might seem. However, it is of value to discuss the apparent relationships of the Straits trochid fauna with respect to the worldwide fauna as well as the Western Atlantic trochids.

At the generic level, the Straits Trochidae seem to show a strong affinity with the other tropical areas of the world. Five genera (36%) can be considered circumtropical, and 3 more (21%) are cosmopolitan in tropical and temperate waters. That these genera are, for the most part, depauperate in the Western Atlantic, and that there are three more genera which are restricted to the Western Atlatnic, is to be expected when one considers the climatic changes during the late Miocene (Ekman, 1953). Even when the genera which have no species occurring deeper than 180 m (*Tegula* and *Cittarium*) are eliminated from the analysis, the results remain virtually unchanged.

The 54 species (including subspecies) with maximum recorded depths of greater than 180 m fall into 5 divisions: Tropical West Atlantic, Temperate, Northwest Atlantic, Amphi-Atlantic and Endemic Straits. The largest of these is the Tropical West Atlantic component with 27 species (50%) indicating that the Straits area is within the tropical domain of the Western Atlantic, although at the northern edge. As is to be expected for a marginal region, there is also a rather strong influence from the warm temperate area to the north. In the Straits, the Temperate Northwest Atlantic component forms 18.5% (10 species) of the total. These species are fairly common from Cape Hatteras to the northern parts of the Straits, a few species occurring as far south as Key West, and 3 species (*Calliostoma pulchrum, C. yucatecanum,* and *C. psyche*) are also known from the eastern Gulf of Mexico.

TABLE 1. List of Tropical West Atlantic Trochidae.

Calliostoma echinatum	*Dentistyla asperrima*
Calliostoma jujubinum	*Microgaza rotella rotella*
Calliostoma schroederi	*Microgaza vetula*
Calliostoma sapidum	*Mirachelus corbis*
Calliostoma brunneum	*Mirachelus clinocnemus*
Calliostoma barbouri	*Gaza fischeri*
Solariella multirestis	*Gaza watsoni*
Solariella pourtalesi	*Euchelus guttarosea*
Solariella lubrica	*Basilissa alta*
Calliotropis aeglees	*Basilissa discula*
Calliotropis calatha	*Basilissa costulata*
Calliotropis lissocona	*Lischkeia imperialis*
Calliotropis actinophora	*"Solariella" tiara*
Echinogurges clavatus	

TABLE 2. List of Temperate Northwest Atlantic Trochidae.

Calliostoma pulchrum	*Solariella constricta*
Calliostoma yucatecanum	*Echinogurges anoxia*
Calliostoma psyche	*Echinogurges tubulatus*
Calliostoma sayanum	*Microgaza rotella inornata*
Solariella tubula	*Basilissa rhyssa*

Four species (8%) may be termed Western North Atlantic, their ranges extending from the Carolina capes south through the Antillean arc. Species included are *Calliostoma roseolum, Solariella lacunella, Solariella lamellosa,* and *Dentistyla dentifera.*

The Amphi-Atlantic and Endemic Straits components comprise three species each (6%). *Margarites euspira, Calliotropis rhina,* and *Echinogurges rhysus* are known from the eastern Atlantic as well as the West Indies. Those species known only from the Straits of Florida are: *Calliostoma hendersoni, Margarites bairdi,* and *Gaza superba cubana.*

In examining the affinities of the shallow-water trochids, all species whose depth ranges fell either wholly or in part in the 0–180 m range were included. With this restriction, 26 species can be included, some of which also occur deeper than 180 m. These species fall into 3 groups: Tropical West Atlantic, Temperate Northwest Atlantic and Western North Atlantic. The shallow water forms show a very great tropical influence with 18 species (69%) assignable to the Tropical West Atlantic fauna. The Temperate Northwest Atlantic component contributes 4 species (15%) and the Western North Atlantic component comprises 3 species (12%), both significant contributions, although not very strong when compared to the tropical influence.

Eight species, all in the genus *Calliostoma (torrei, cubanum, atlantis, jeanneae, bigelowi, cinctellum, circumcinctum* and *orion*), were not relegated to a faunal group since all are known only from one or two specimens near Cuba. They may well belong in the tropical element, so the Tropical West Atlantic components could be as strong as 63% for the Jeep water forms and 73% for the shallow water species.

Ninety-five percent of the total trochid fauna of the Straits of Florida (65 species) is restricted to the Western North Atlantic, but most of the genera are rather widespread. This can be explained by applying the principles advanced by Ekman (1953). After the Atlantic basin had become a substantial feature, the original Tethyan fauna of the Atlantic was severely decimated by the late Miocene climatic cooling. When water temperatures once again reached tropical nature, the relict fauna reinvaded the Wesern North Atlantic and resulted in a unique fauna which was isolated on the east by the still widening Atlantic, and on the west by the Isthmus of Panama. Species such as *Solariella lacunella, S. lamellosa, Margarites euspira* and *M. bairdi* are probably remnants of the cooler water species which moved into the tropical areas during the glacial periods and were flexible enough to adapt to the elevated water temperatures of the post-Miocene period. From this we see a fauna that is 100% endemic in the shallow water species and 94% endemic in the deep water species.

Bathymetric analysis.—The Straits trochid fauna appears to fall into the bathymetric zones proposed by Ekman (1953) with some modification of the limits set for the bathyal zone. The littoral, or shelf, fauna extends from the tidal area down to about 150–180 m in the Straits. This is somewhat shallower than the 200 m boundary used by Ekman (1953), Bruun (1957) and Voss (1967), but in the trochid fauna at least there is a distinct break in the species composition occurring in the 150–180 m depths. The littoral trochid fauna of the Straits is composed of 26 species, and is dominated by the genus *Calliostoma* (14 species, 54%). Fifteen species which are here allocated to the littoral zone are also known from deeper than 180 m, but almost all of these records are probably fortuitous occurrences and only one species (*Solariella lamellosa*) can be considered a true inhabitant of both the littoral and bathyal zones. One other species, *Calliostoma psyche,* is known from shallow water in the northern part of its range, but has not been taken in the littoral of the Straits area.

The bathyal zone extends down to about 2000 m, or to about the 4°C isotherm. The majority of the trochid species in the Straits (39 species, 60%) are to be found in this zone. There seems to be a slight break at about 1000 m. This break is not a distinct change in species composition, but rather a rapid diminution in the number of species found at that depth. This may be an indication of a true faunal break as suggested by Ekman (1953). However, it may be an artificial break introduced by the fact that only the southwestern part of the Straits off Cuba is deeper than 1000 m and has been less thoroughly sampled than the shallower areas. Here, then, I am terming the depths from 180–1000 m the upper bathyal, and those from 1000–2000 m the lower bathyal. Only 3 species occur exclusively in the lower bathyal of the Straits: *Margarites euspira, Calliotropis actinophora* and *Echinogurges clavatus.*

Only 1 species (*Solariella pourtalesi*) is known from abyssal depths in the Straits, occurring as deep as 2350 m.

TABLE 3. Trochidae of the Lower Bathyal Zone.

Solariella pourtalesi	*Gaza superba cubana*
"Solariella" tiara	*Gaza fischeri*
Margarites bairdi	*Gaza watsoni*
Margarites euspira	*Basilissa alta*
Echinogurges clavatus	*Basilissa discula*
Echinogurges rhysus	*Basilissa rhyssa*
Calliotropis actinophora	*Basilissa costulata*

TABLE 4. Trochidae of the Upper Bathyal Zone.

Calliostoma psyche	*Mirachelus corbis*
Calliostoma hendersoni	*Calliotropis aegleis*
Calliostoma schroederi	*Calliotropis rhina*
Calliostoma sapidum	*Calliotropis calatha*
Calliostoma sayanum	*Calliotropis lissocona*
Solariella lamellosa	*Echinogurges anoxia*
Solariella lubrica	*Echinogurges rhysus*
Solariella multirestis	*Echinogurges tubulatus*
Solariella constricta	*Gaza superba cubana*
Solariella tubula	*Gaza fischeri*
Solariella pourtalesi	*Gaza watsoni*
"Solariella" tiara	*Basilissa alta*
Lischkeia imperialis	*Basilissa costulata*
Dentistyla asperrima	*Basilissa discula*
Dentistyla dentifera	*Basilissa rhyssa*

We see here a striking increase in the number of trochid species with increasing depth, at least to about 1000 m. Hickman (1974) noted this trend in a survey of the Tertiary and Recent faunal assemblages of the Pacific coast of North America. She also found that the increase in the number of species resulted in a disproportionate increase in the percent composition of the total fauna. There are indications that this holds true in the Straits area, but since it is very difficult to determine the total number of prosobranch species found in the Straits, it is impossible to quantify this trend at present. We can get a little better idea of the relative numbers of individuals and the importance of the trochids in this respect. Okutani (1968) reported that *Bathybembix aeola* (Watson) was the most numerous species in the bathyal fauna of Sagami Bay. The collections of the GERDA indicate the same importance of trochids in the bathyal fauna of the Straits, at least with respect to gross number of specimens. Of the almost 1800 specimens collected by the GERDA in the Straits, 342 (19%) are trochids, second in number only to the Turridae (385 specimens, 21.5%).

TABLE 5. List of Littoral Trochidae.

Calliostoma pulchrum	*Calliostoma sarcodum*
Calliostoma roseolum	*Solariella lucunella*
Calliostoma yucatecanum	*Solariella lamellosa*
Calliostoma echinatum	*Microgaza rotella rotella*
Calliostoma jujubinum	*Microgaza rotella inornata*
Calliostoma brunneum	*Microgaza vetula*
Calliostoma barbouri	*Mirachelus clinocnemus*
Calliostoma fascinans	*Euchelus guttarosea*
Calliostoma javanicum	*Lischkeia imperialis*
Calliostoma adelae	*Cittarium pica*
Calliostoma euglyptum	*Tegula fasciata*
Calliostoma marionae	*Tegula lividomaculata*
Calliostoma orion	*Tegula excavata*

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LITERATURE CITED

ABBOTT, R. T., 1974, *American seashells.* Ed. 2. Van Nostrand Reinhold, New York, 663 p.

ADAMS, A., 1854, Further contributions towards the natural history of the Trochidae. *Proceedings of the Zoological Society of London,* 22: 37–41.

ADAMS, A., 1864, Descriptions of a new genus and twelve species of Mollusca. *Proceedings of the Zoological Society of London,* 30: 506–509.

ADAMS, C. B., 1845, Specierum novarum conchyliorum, in Jamaica repertorum, synopsis. *Proceedings of the Boston Society of Natural History,* 2: 1–17.

ADAMS, C. B., 1850, Descriptions of supposed new species of marine shells which inhabit Jamaica. *Contributions to Conchology,* 1(5): 69–75.

AGUAYO, C. G., 1949, Neuvos moluscos fosiles de la Republica Dominicana. *Revista de la Sociedad Malacologica 'Carlos de la Torre,'* 6: 91–92.

BAYER, F. M., 1971, New and unusual mollusks collected by R/V JOHN ELLIOTT PILLSBURY and R/V GERDA in the tropical western Atlantic. *Bulletin of Marine Science,* 21: 111–236.

BORN, I. VON, 1778, *Index Rerum Naturalium Musei Caesarei Vindobonensis.* Pars Prima, Testacea. Vienna, xlii + 458 + 78 p.,1 pl.

BRUUN, A. F., 1957, Deep sea and abyssal depths. *Geological Society of America, Memoirs,* 67: 641–672.

CAIRNS, S. D., 1973, The distribution of the cephalopods collected by the R/V GERDA in the Straits of Florida. M. S. Thesis, University of Miami, viii + 221 p.

CHEMNITZ, J. H., 1781, *In* MARTINI, F. H. W. & CHEMNITZ, J. H., 1769–1795, *Neues Systematisches Conchylien-Cabinet.* Vol. 5. Nurnberg, 324 p. + Atlas, 213 pl.

CLENCH, W. J. & ABBOTT, R. T., 1943, The genera *Gaza* and *Livona* in the Western Atlantic. *Johnsonia,* 1(12): 1–9, 4 pl.

CLENCH, W. J. & AGUAYO, C.G., 1938, Notes and descriptions of new species of *Calliostoma, Gaza* and *Columbarium* (Mollusca) obtained by the Harvard-Habana Expedition off the coast of Cuba. *Memorias de la Sociedad Cubana de Historia Natural,* 12: 375–384.

CLENCH, W. J. & AGUAYO, C. G., 1939, Notes and descriptions of new deepwater Mollusca obtained by the Harvard-Habana Expedition off the coast of Cuba. II. *Memorias de la Sociedad Cubana de Historia Natural,* 13: 189–197.

CLENCH, W. J. & AGUAYO, C. G., 1940, Notes and descriptions of new deepwater Mollusca obtained by the Harvard-Habana Expedition off the coast of Cuba. III. *Memorias de la Sociedad Cubana de Historia Natural,* 14: 77–94.

CLENCH, W. J. & AGUAYO, C. G., 1941, Notes and descriptions of new deepwater Mollusca obtained by the Harvard-Habana Expedition off the coast of Cuba. IV. *Memorias de la Sociedad Cubana de Historia Natural,* 15: 177–180.

CLENCH, W. J. & AGUAYO, C. G., 1946, Notes and descriptions of two new species of *Calliostoma* from Cuba. *Revista de la Sociedad Malacologica 'Carlos de la Torre,'* 4: 88–90.

CLENCH, W. J. & TURNER, R. D., 1950, The Western Atlantic marine mollusks described by C. B. Adams. *Occasional Papers on Mollusks,* 1: 233–404.

CLENCH, W. J. & TURNER, R. D., 1960, The genus *Calliostoma* in the Western Atlantic. *Johnsonia,* 4: 1–80, 56 fig.

CONRAD, T. A., 1846, Descriptions of nineteen new species of fossil and Recent shells and corals of the United States. *Proceedings of the Academy of Natural Sciences of Philadelphia,* 3: 19–27.

COSSMANN, M., 1888, Note rectificative sur la nomenclature d'un genre de coquilles fossiles. *Journal de Conchyliologie,* 36: 335.

COSSMANN, M., 1918, *Essais de Paléoconchologie comparée.* Vol. 11. Paris, 388 p., 128 text figs., 11 pl.

COTTON, B. C., 1959, *South Australian Mollusca. Archaeogastropoda. Handbook of the flora and fauna of South Australia.* Government Printer, Adelaide, 449 p., 215 fig., 1 pl.

DALL, W. H.,1878, Preliminary note on mollusks of the BLAKE Expedition. *Bulletin of the Museum of Comparative Zoology,* 5: 55–64.

DALL, W. H., 1880, Reports on the results of dredging . . . in the Gulf of Mexico (1877–78), by the U.S. Coast Survey steamer "Blake." 5. General conclusions from a preliminary examination of the Mollusca. *Bulletin of the Museum of Comparative Zoology,* 6: 85–93.

DALL, W. H., 1881, Preliminary report on the Mollusca. Reports on the results of dredging . . . in the Gulf of Mexico, and in the Caribbean Sea, 1877–1879, by the United States Coast Survey steamer "Blake" . . . *Bulletin of the Museum of Comparative Zoology,* 9: 33–144.

DALL, W. H., 1885, List of marine Mollusca comprising the Quaternary fossils and Recent forms from American localities between Cape Hatteras and Cape Roque including the Bermudas. *United States Geological Survey Bulletin,* 24: 1–336.

DALL, W. H., 1889a, Report on the Mollusca. Part II. Gastropoda and Scaphopoda. Reports on the results of dredging . . . in the Gulf of Mexico (1877–78) and in the Caribbean Sea (1878–80), by the U.S. Coast Survey steamer "Blake" . . . *Bulletin of the Museum of Comparative Zoology,* 18: 1–492.

DALL, W. H., 1889b, A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States. *United States National Museum, Bulletin,* 37: 1–221.

DALL, W. H., 1890, Preliminary report on the collection of Mollusca and Brachiopoda obtained in 1887–88. Scientific results of explorations by the

U.S. Fish Commission steamer "Albatross." No. VII. *Proceedings of the United States National Museum,* 12: 219–362.

DALL, W. H., 1903, Contributions to the Tertiary fauna of Florida. Part 6. *Transactions of the Wagner Free Institute of Science, Philadelphia,* 3: 1219–1654.

DALL, W. H., 1908, The Mollusca and the Brachiopoda. Reports on the scientific results of the expedition to the eastern tropical Pacific . . . by the U.S. Fish Commission steamer "Albatross" . . . *Bulletin of the Museum of Comparative Zoology,* 43: 205–487, 22 pl.

DALL, W. H., 1919, Descriptions of new species of Mollusca from the north Pacific Ocean in the collection of the United States National Museum. *Proceedings of the United States National Museum,* 56: 293–371.

DALL, W. H., 1924, Notes on molluscan nomenclature. *Proceedings of the Biological Society of Washington,* 37: 87–90.

DALL, W. H., 1927a, Small shells from dredgings off the southeast coast of the United States by the United States Fisheries steamer "Albatross" in 1885 and 1886. *Proceedings of the United States National Museum,* 70: 1–134.

DALL, W. H., 1927b, Diagnoses of undescribed new species of mollusks in the collection of the United States National Museum. *Proceedings of the United States National Museum,* 70: 1–11.

DAUTZENBERG, P., 1900, Croisières du yacht CHAZALIE dans l'Atlantique. *Société Géologique de France, Mémoires,* 13: 145–265.

DEVANY, T., 1969, Ecological interpretation of distribution of the lanternfishes (Myctophidae) in the Straits of Florida. Ph.D. Dissertation, University of Miami, xi + 431 p.

EKMAN, S., 1953, *Zoogeography of the Sea.* Sidgwick & Jackson, London, xiv + 417 p.

FISCHER, P., 1875, Genres *Calcar, Trochus. In:* KIENER, L. C., 1834–1880, *Species général et Iconographie des coquilles vivantes* . . . Vol. 11, p. 1–96. Paris.

FISCHER, P., 1879, Genres *Xenophora, Tectarius, Risella. In:* KIENER, L. C., 1834–1880, *Species général et Iconographie des coquilles vivantes* . . . Vol. 11, p. 337–463. Paris.

FISCHER, P., 1880–1887, *Manuel de conchyliologie et de paléontologie conchyliologique, ou Histoire naturelle des Mollusques vivantes et fossiles.* Savy, Paris, xxiv + 1369 p.

FRIELE, H., 1877, Tungebevaebningen hos de norske Rhipidoglossa. *Archiv for Mathematik og Naturvidenskab,* 2: 299–317.

GMELIN, J. F., 1791, *Caroli a Linné Systema naturae per regna tria naturae.* Editio decima tertia aucta reformata. Vol. 1, part 6, p. 3021–3910. Lipsiae.

GRAY, J. E., 1840, *Synopsis of the contents of the British Museum.* London, iv + 370 p.

GRAY, J. E., 1843, Catalogue of the species of Mollusca, *In:* DIEFFENBACH, E., *Travels in New Zealand, with contributions to the Geology, Botany and Natural History of that country.* Vol. 2, p. 228–265. London.

GRAY, J. E., 1847a, A list of the genera of Recent Mollusca, their synonyma and types. *Proceedings of the Zoological Society of London,* 15: 129–219.

GRAY, J. E., 1847b, The classification of the British Mollusca. *Annals and Magazine of Natural History,* (1)20: 267–273.

GRAY, J. E., 1857, *Guide to the systematic distribution of the Mollusca in the British Museum.* London, xii + 230 p.

GREGORIO, A. DE, 1886, Monographie des fossiles de Valpore (Mont Grappa) du sous-horizon Grappin de Greg. *Annales de Géologie et de Paléontologie, Palermo,* 2: 1–20, pl. 1–6.

GUPPY, J. L. & DALL, W. H., 1896, Descriptions of Tertiary fossils from the Antillean region. *Proceedings of the United States National Museum,* 19: 303–331.

HAECKEL, E., 1862, *Die Radiolarien (Rhizopoda Radiolaria). Eine monographie.* xiv + 572 p., 35 pl.

HERRMANNSEN, A. N., 1846–47, *Indicis generum Malacozoorum primordia* . . . Vol. 1. Cassellis, xxvii + 637 p.

HICKMAN, C. S., 1974, Characteristics of bathyal mollusk faunas in the Pacific Coast Tertiary. *Western Society of Malacologists Annual Report,* 7: 41–50.

HUMPHREY, M., 1975, *Sea shells of the West Indies.* Taplinger Publishing Co., New York, 351 p., 32 pl., 19 text fig.

INTERNATIONAL CODE OF ZOOLOGICAL NOMENCLATURE ADOPTED BY THE XV INTERNATIONAL CONGRESS OF ZOOLOGY. 1961. London, International Trust for Zoological Nomenclature, xix + 176 p. Reprinted 1964.

JEFFREYS, J. G., 1865, *British Conchology.* Vol. 3. Van Voorst, London, 393 p., 8 pl.

JEFFREYS, J. G., 1883, On the Mollusca procured during the 'Lightning' and 'Porcupine' Expeditions, 1868–70. Part 6. *Proceedings of the Zoological Society of London,* for 1883: 88–115.

JOHNSON, C. W., 1934, List of marine Mollusca of the Atlantic coast from Labrador to Texas. *Proceedings of the Boston Society of Natural History,* 40: 1–204.

JORDAN, G. F. & STEWART, H. B. Jr., 1961, Submarine topography of the western Straits of Florida. *Geological Society of America, Bulletin* 72: 1051–1058.

JORDAN, G. F., HURLEY, R. J. & KOFOED, J. W., 1964, Bathymetry and geology of Pourtalès Terrace, Florida. *Marine Geology,* 1: 259–287.

KEEN, A. M., 1960, *In:* MOORE, R. C. (ed.), *Treatise on Invertebrate Paleontology,* Part I, Mollusca 1. Geological Society of America, University of Kansas Press, xxiii + 351 p., 216 text fig.

KOFOED, J. W. & MALLOY, R. J., 1964, Bathymetry of the Miami Terrace. *Southeastern Geology,* 6: 159–165.

LAMARCK, J. B. P. DE MONET DE, 1822, *Histoire naturelle des Animaux sans vertèbres, présentant les caractères généraux et particuliers de ces Animaux . . . précédé d'une introduction offrant la détermination des caractères essentiels de l'animal . . . enfin, l'exposition des principes fondamentaux de la Zoologie.* Vol. 7. Paris, 711 p.

LEACH, W. E., 1814, *The Zoological miscellany; being descriptions of new, or interesting Animals.* Vol. 1. London.

LEACH, W. E., 1819, Descriptions of the new species of Animals discovered by His Majesty's Ship ISABELLA, in a Voyage to the Arctic Regions. *Annals of Philosophy and Magazine of Chemistry, Mineralogy, Mechanics, Natural History, Agriculture and the Arts,* 14: 201–206.

LESKE, N. G., 1778, *Additamenta ad Jacobi Theodori Klein naturalem dispositionem Echinodermatum et lucubratiunculam de aculeis Echinorum marinorum.* Lipsiae, iv + xx + 214 + 4 p., pl. xxxvii–liv.

LINNAEUS, C., 1758, *Systema naturae per regna tria naturae.* Editio decima, reformata. Vol. 1. Holmiae, ii + 824 p.

MCLEAN, J. H., 1970, New species of tropical eastern Pacific Gastropoda. *Malacological Review,* 2: 115–130.

MCLEAN, J. H., 1971, Archaeogastropoda. *In:* KEEN, A. M., *Marine shells of tropical West America.* Ed. 2. Stanford University Press, Stanford, p. 308–363.

MALLOY, R. J. & HURLEY, R. J., 1970, Geomorphology and geologic structure: Straits of Florida. *Geological Society of America, Bulletin,* 81: 1947–1972.

MELVILL, J. C., 1897, Upon the principles of nomenclature, and their application to the genera of Recent Mollusca. *Journal of Conchology,* 8: 435–479.

MERRILL, A. S., 1970a, *Fluxina* Dall is a *Calliostoma* Swainson. *Nautilus,* 84: 32–34.

MERRILL, A. S., 1970b, The family Architectonicidae (Gastropoda: Mollusca) in the western and eastern Atlantic. Ph.D. Dissertation, University of Delaware.

MESSING, C. G., 1975, The systematics and distribution of the Crinoidea Comatulida (exclusive of the Macrophreatina) collected by the R/V GERDA in the Straits of Florida and adjacent waters. M.S. Thesis, University of Miami, x + 285 p.

MONTEROSATO, T. A. DI, 1889, Molluschi del Porto di Palermo. *Bullettino Società Malacologica Italiana,* 14: 75–81.

MONTEROSATO, T. A. DI, 1890, Conchiglie della profundita del mare di Palermo. *Naturalista Siciliano,* 9: 140–151.

NARDO, G. D., 1840, *Conulus* n. gen. *Atti della Scienziate Italiani Riunione,* 2: 244–245.

OKUTANI, T., 1968, Systematics, ecological distribution, and paleoecological implication of archibenthal and abyssal Mollusca from Sagami Bay and adjacent areas. *Journal of the Faculty of Science, University of Tokyo,* (II)17: 1–91.

OLSSON, A. A., 1971, Mollusks from the Gulf of Panama collected by R/V JOHN ELLIOTT PILLSBURY, 1967. *Bulletin of Marine Science,* 21: 35–92.

PERRON, F. E., 1975, Carnivorous *Calliostoma* (Prosobranchia: Trochidae) from the Northeastern Pacific. *Veliger,* 18(1): 52–54.

PHILIPPI, R. A., 1843, *Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien.* Vol. 1. Kassel, p. 21–76.

PHILIPPI, R. A., 1844, *Abbildungen und Beschreibungen neuer oder wenig gekannter Conchylien.* Vol. 1. Kassel, p. 77–186.

PHILIPPI, R. A., 1847a, Versuch einer systematischen Eintheilung des Geschlectes *Trochus. Zeitschrift für Malakozoologie,* year 4, p. 17–26.

PHILIPPI, R. A., 1847b, Die Kreiselschnecken, oder Trochoideen. *In:* KÜSTER, H. C., KOBELT, W. & WEINKAUFF, H. C., 1837–1920, *Systematisches Conchylien-Cabinet von Martini und Chemnitz, neu herausgegeben. . .* Vol. 2, p. 25–66. Nurnberg.

PIERCE, B. & PATTERSON, C. P., 1879, List of dredging stations occupied by the United States Coast Survey steamers CORWIN, HASSLER and BLAKE from 1867 to 1879. *Bulletin of the Museum of Comparative Zoology,* 6: 1–15.

PILSBRY, H. A., 1889, Trochidae, Stomatiidae, Pleurotomariidae, Haliotidae. *In:* TRYON, G. W., 1879–1913, *Manual of Conchology.* Philadelphia, series 1, vol. 11, 519 p., 67 pl.

PILSBRY, H. A., 1900, A new *Calliostoma* from Florida. *Nautilus,* 13: 128–129.

POWELL, A. W. B., 1951, Antarctic and subantarctic Mollusca: Pelecypoda and Gastropoda. *Discovery Reports,* 26: 47–196.

REEVE, L. A., 1863, *Zizyphinus. Conchologica Iconica.* Vol. 14, 8 pl., 65 fig. London.

REHDER, H. A., 1955, The genus *Turcicula* Dall. *Proceedings of the Malacological Society of London,* 31: 222–226.

REHDER, H. A. & LADD, H. S., 1973, Deep and shallow-water mollusks from the Central Pacific. *Science Reports of the Tohoku University,* Sendai, Japan, 2nd Ser. (Geology), Special Volume, No. 6 (Hatai Memorial Volume), p. 37–49.

RICE, W. H. & KORNICKER, L. S., 1965, Mollusks from the deeper waters of the northwestern Campeche Bank, Mexico. *Publications of the Institute of Marine Science,* 10: 108–178.

ROBINS, C. H., 1968, The comparative osteology and ecology of the synaphobranchid eels of the Straits of Florida. Ph.D. Dissertation, University of Miami, xii + 149 p.

RÖDING, P. F., 1798, *Museum Boltenianum sive Catalogus Cimeliorum e tribus regnis naturae . . . pars secunda, continens Conchylia sive Testacea univalvia, bivalvia et multivalvia.* Hamburg, i + vii + 109 p.

SARS, G. O., 1878, Bidrag til Kundskaben om Norges arktiske Fauna. 1. Mollusca regionis

arcticae Norvegiae. *Oversigt over de i Norges arktiske region forekommende Blφddyr.* Christiania, 466 p., 52 pl.

SCHEPMAN, M. M., 1908, The Prosobranchia of the Siboga Expedition. Part 1. Rhipidoglossa and Docoglossa. *Résultats des Explorations Zoologiques, Botaniques, Océanographique et Géologique . . . à bord du Siboga,* Monographie 49'a, Livre 39: 1–107, 9 pl.

SCHWENGEL, J. S., 1942, New Floridian marine mollusks. *Nautilus,* 56: 62–66.

SCHWENGEL, J. S., 1951, New marine mollusks from British West Indies and Florida Keys. *Nautilus,* 64: 116–119.

SCHWENGEL, J. S. & MCGINTY, T. L., 1942, Some new and interesting marine shells from North-west Florida. *Nautilus,* 56: 13–18.

SEGUENZA, G., 1876, Studii stratigraphici sulla formazione pliocenica dell'Italia meridionale. *Reale Comitato Geologico Italiano, Bolletino,* 7: 179–189.

SEGUENZA, G., 1903, Molluschi poco noti dei terreni terziarii di Messina. *Societa Geologica Italiana, Bolletino,* 21: 455–464.

SMITH, S., 1889, Lists of the dredging stations of the U.S. Fish Commission, the U.S. Coast Survey, and the British steamer CHALLENGER, in North American waters, from 1867 to 1887, together with those of the principal European government expeditions in the Atlantic and Arctic Oceans. *United States Commission of Fish and Fisheries* XIV. *Report of the Commissioner for 1886,* 29: 871–1017.

SOWERBY, G. B. (II), 1874, Descriptions of twelve new species of shells. *Proceedings of the Zoological Society of London,* for 1873: 718–722.

STAIGER, J. C., 1970, The distribution of the benthic fishes found below two hundred meters in the Straits of Florida. Ph.D. Dissertation, University of Miami, 219 p.

SWAINSON, W., 1840, *A Treatise on Malacology; or the natural classification of Shells and Shellfish.* VIII. London, viii + 419 p.

TAKI, I. & OTUKA, Y., 1942, Genus *Turcicula* Dall. *Conchologia Asiatica,* 1: 93–108.

THIELE, J., 1929, *Handbuch der systematischen Weichtierkunde.* Part 1, p. 1–376. Fischer, Jena.

TRYON, G. W., 1887, Solariidae, Ianthinidae, Trichotropidae, Scalariidae, Cerithiidae, Rissoidae, Littorinidae. *In*: TRYON, G. W., 1879–1913, *Manual of Conchology.* Philadelphia, series 1, vol. 9, 488 p., 71 pl.

VERRILL, A. E., 1880, Notice of recent additions to the marine Invertebrata of the northeastern coast of America . . . Parts 2 & 3. *Proceedings of the United States National Museum,* 3: 356–409.

VERRILL, A. E., 1882, Catalogue of marine Mollusca added to the fauna of New England during the past ten years. *Transactions of the Connecticut Academy of Arts and Sciences,* 5: 447–587, pl. 42–44, 52–53.

VERRILL, A. E. & SMITH, S., 1880, *In*: VERRILL, A. E., 1880, Notice of the remarkable marine fauna occupying the outer banks of the southern coast of New England. *American Journal of Science,* (3)20: 390–403.

VOSS, G. L., 1967, The biology and bathymetric distribution of deepsea cephalopods. *Studies in Tropical Oceanography, Miami,* 5: 511–535.

WATSON, R. B., 1879, Mollusca of H.M.S. CHALLENGER Expedition. III. Trochidae, viz. the genera *Seguenzia, Basilissa, Gaza,* and *Bembix. Journal of the Linnean Society of London, Zoology,* 14: 586–605.

WATSON, R. B., 1886, Report on the Scaphopoda and Gasteropoda collected by H. M. S. CHALLENGER during the years 1873–76. *Report on the Scientific Results of the Voyage of H. M. S. CHALLENGER, 1873–1876, Zoology,* 15(part 42): 1–680, pl. 1–50.

WENNEKENS, M. P., 1959, Water mass properties of the Straits of Florida and related waters. *Bulletin of Marine Science of the Gulf and Caribbean,* 9: 1–52.

WENZ, W., 1938, Gastropoda. Allgemeine Teil und Prosobranchia. *Handbuch der Paläozoologie,* Band 6, Teil 1, Lieferung 2, p. 241–480, fig. 472–1235.

WOOD, S. V., 1842, A catalogue of shells from the Crag. *Annals and Magazine of Natural History,* (1)9: 527–544.

WOODRING, W. P., 1928, Miocene mollusks from Bowden, Jamaica, II. Gastropods. *Carnegie Institution of Washington, Publication* 385, p. 1–564, pl. 1–40.

APPENDIX: STATION DATA

Ship	Sta. no.	Date	Position	Depth (m)	Gear
GERDA	4	5/4/62	25°49′N, 79°59.5′W	256	OT[1]
GERDA	23	6/20/62	25°32′N, 79°44′W	768	IKMT[1]
GERDA	56	8/28/62	25°31′N, 79°20′W	458	Lyman Dredge
GERDA	126	6/20/63	24°03′N, 81°49′W	805–741	OT
GERDA	128	6/20/63	23°49′N, 81°37′W	1391–1464	10′ OT
GERDA	129	6/20/63	23°46′N, 81°15′W	1281	10′ OT
GERDA	130	6/21/63	23°59′N, 81°10′W	1021	10′ OT
GERDA	132	6/21/63	24°26′N, 80°49′W	288	10′ OT
GERDA	134	6/21/63	24°30′N, 80°51′W	191	10′OT
GERDA	190	7/4/63	25°57′N, 78°07′W	732–896	OT
GERDA	226	1/23/64	24°40′N, 80°04′W	803	6′ OT
GERDA	289	4/3/64	24°11′N, 81°36′W	594–604	10′ OT
GERDA	300	4/5/64	26°16′N, 79°30′W	640	10′ OT
GERDA	357	8/25/64	25°28′N, 79°31′W	842	6′OT
GERDA	362	9/15/64	24°11′N, 81°39′W	631	10′OT
GERDA	365	9/15/64	24°11′N, 81°37′W	672	10′ OT
GERDA	366	9/15/64	24°12′N, 81°17′W	679–709	10′ OT
GERDA	368	9/15/64	24°03′N, 81°10′W	961–1016	16′ OT
GERDA	374	9/17/64	23°50′N, 81°37′W	1208–1241	16′ OT
GERDA	375	9/17/64	23°54′N, 81°27′W	1153–1190	16′ OT
GERDA	432	11/28/64	24°19′N, 82°29′W	188–199	10′ OT
GERDA	439	11/29/64	24°14′N, 82°29′W	583–565	10′ OT
GERDA	446	11/30/64	23°57′N, 82°32′W	988–1071	10′ OT
GERDA	448	12/1/64	23°54′N, 82°21′W	1135–1184	10′ OT
GERDA	449	12/1/64	23°55′N, 82°05′W	1373–1428	10′OT
GERDA	451	1/22/65	25°02′N, 80°11′W	199	10′ OT
GERDA	459	1/24/65	24°20′N, 82°52′W	187–192	10′ OT
GERDA	482	1/26/65	24°31′N, 80°51′W	205	2.5′ Scal. Dr.[1]
GERDA	483	1/27/65	24°30′N, 80°28′W	443	10′ OT
GERDA	484	1/27/65	24°33′N, 80°25′W	403	10′ OT
GERDA	524	3/3/65	26°17′N, 78°41′W	513–715	10′ OT
GERDA	598	4/15/65	24°47′N, 80°26′W	183	2.5′ Scal. Dr.
GERDA	606	4/15/65	25°18′N, 80°04′W	183	Brattstrom Dr.
GERDA	611	4/15/65	25°25′N, 80°05′W	119	Brattstrom Dr.
GERDA	636	6/30/65	26°04′N, 79°13′W	87	2.5′ Scal. Dr.
GERDA	693	7/21/65	26°34′N, 78°26′W	275–293	10′OT
GERDA	813	6/21/67	24°35′N, 80°37′W	201	Scallop Dr.
GERDA	815	6/22/67	24°08′N, 79°48′W	618	10′ OT
GERDA	824	7/7/67	25°37′N, 80°02′W	187–220	10′ OT
GERDA	830	7/7/67	25°40′N, 79°59′W	342	10′ OT
GERDA	834	7/10/67	25°15′N, 80°10′W	86–79	10′ OT
GERDA	837	7/11/67	24°29′N, 80°59′W	193	10′ OT
GERDA	839	7/11/67	24°23′N, 80°52′W	239	10′ OT
GERDA	847	8/2/67	25°49′N, 80°03.5′W	201–137	10′ OT
GERDA	854	8/25/67	25°27′N, 80°02′W	221	Pipe Dr.
GERDA	857	8/25/67	25°22′N, 80°03′W	194–186	10′ OT
GERDA	859	8/29/67	23°54′N, 81°57′W	1161–1200	10′ OT
GERDA	861	8/29/67	24°08′N, 81°36′W	514–558	10′ OT
GERDA	866	8/29/67	24°28′N, 81°09′W	187	10′ OT
GERDA	897	9/10/67	20°59′N, 86°24′W	293–210	10′ OT
GERDA	915	9/26/67	25°54′N, 78°12′W	439	10′ OT
GERDA	917	9/26/67	25°59′N, 78°12′W	658–704	10′ OT
GERDA	918	9/26/67	26°03′N, 78°05′W	814	10′ OT
GERDA	923	9/28/67	24°02′N, 77°34′W	1554–1573	10′ OT
GERDA	947	1/27/68	21°13′N, 86°25′W	284–247	Triangular Dr.
GERDA	959	1/31/68	23°25′N, 82°35′W	1830	10′ OT
GERDA	960	1/31/68	23°30′N, 82°26′W	1692–1697	10′ OT
GERDA	963	2/1/68	23°41′N, 82°16′W	1441–1454	10′ OT

APPENDIX (continued)

Ship	Sta. no.	Date	Position	Depth (m)	Gear
GERDA	964	2/1/68	23°46'N, 81°51'W	1390–1414	10' OT
GERDA	965	2/1/68	23°45'N, 81°49'W	1394–1399	10' OT
GERDA	966	2/2/68	24°10'N, 82°22'W	553–558	10' OT
GERDA	967	2/2/68	24°15'N, 82°26'W	499–503	10' OT
GERDA	968	2/2/68	24°17'N, 82°34'W	499–503	10' OT
GERDA	969	2/2/68	24°18'N, 82°33'W	269–402	10' OT
GERDA	970	2/2/68	24°24'N, 82°08'W	512	10' OT
GERDA	974	2/3/68	24°22'N, 80°57'W	250–252	10'OT
GERDA	984	3/5/68	24°05'N, 80°20'W	192	Triangular Dr.
GERDA	985	3/5/68	24°06'N, 80°12'W	119	Triangular Dr.
GERDA	986	3/5/68	24°05'N, 80°19'W	189	10' OT
GERDA	1008	6/14/68	24°03'N, 79°36'W	540–576	10' OT
GERDA	1011	6/14/68	23°43'N, 79°32'W	291–311	10' OT
GERDA	1015	6/15/68	23°34'N, 79°17'W	525–516	10' OT
GERDA	1018	6/15/68	24°07'N, 79°28'W	556	10' OT
GERDA	1035	2/26/69	24°34.7'N, 80°58.6'W	254–358	10' OT
GERDA	1095	4/28/69	24°20'N, 82°56.5'W	229–274	10' OT
GERDA	1096	4/28/69	24°19'N, 82°55'W	329–366	10' OT
GERDA	1099	4/28/69	24°12.5'N, 82°50'W	622	10' OT
GERDA	1106	4/29/69	24°02'N, 81°30'W	1706–1723	10' OT
GERDA	1107	4/29/69	24°05'N, 81°20'W	1556–1709	10' OT
GERDA	1111	4/30/69	23°51.9'N, 80°42.7'W	1080–1089	10' OT
GERDA	1112	4/30/69	23°44'N, 81°14'W	2276–2360	10' OT
GERDA	1312	3/31/71	26°38.4'N, 79°02.5'W	527–505	10' OT
PILLSBURY	413	7/18/66	09°01.5'N, 76°53'W	1281–963	40' OT
PILLSBURY	585	5/23/67	21°02'N, 86°29'W	567–570	10' OT
PILLSBURY	598	3/15/68	21°07'N, 86°21'W	155–205	10' OT
PILLSBURY	604	3/17/68	18°58'N, 87°28'W	970–988	Box Dr.
PILLSBURY	605	3/17/68	18°50.1'N, 87°31.5'W	695–772	10' OT
PILLSBURY	606	3/17/68	18°45'N, 87°33'W	466–649	10' OT
PILLSBURY	607	3/17/68	18°30'N, 87°37'W	715–787	10' OT
PILLSBURY	610	3/18/68	17°02'N, 87°38.4'W	296–329	10' OT
PILLSBURY	747	7/24/68	11°46'N, 67°05.7'W	1174–1108	10' OT
PILLSBURY	754	7/26/68	11°36.9'N, 68°42'W	684–1574	10' OT
PILLSBURY	776	7/29/68	12°13.3'N, 72°50'W	408–576	10' OT
PILLSBURY	846	7/2/69	11°37.8'N, 60°37.4'W	658–1126	10' OT
PILLSBURY	861	7/4/69	12°42'N, 61°05.5'W	18–744	10' OT
PILLSBURY	874	7/6/69	13°11.2'N, 61°05.3'W	156–201	5' Blake Tr.
PILLSBURY	903	7/9/69	13°44'N, 61°03.1'W	231–430	Triangular Dr.
PILLSBURY	904	7/9/69	13°45.5'N, 61°05.7'W	201–589	Scallop Dr.
PILLSBURY	905	7/9/69	13°46.3'N, 61°05.4'W	384–963	Scallop Dr.
PILLSBURY	919	7/12/69	16°05.3'N, 61°19.3'W	683–733	5' Blake Tr.
PILLSBURY	929	7/15/69	15°29.5'N, 61°11.5'W	457–503	5'Blake Tr.
PILLSBURY	988	7/23/69	18°29.3'N, 63°24.6'W	686–723	5' Blake Tr.
PILLSBURY	1225	7/6/70	17°42.5'N, 77°58'W	457–558	10' OT
PILLSBURY	1255	7/14/70	17°18'N, 78'32'W	622–823	10' OT
PILLSBURY	1256	7/14/70	17°27'N, 78°10'W	521–658	10' OT
PILLSBURY	1261	7/15/70	17°13'N, 77°50'W	595–824	10' OT
PILLSBURY	1262	7/15/70	17°21.4'N, 77°34.8'W	805–1089	10' OT
PILLSBURY	1309	12/5/70	25°44.5'N, 79°50.0'W	311	10' OT
COLUMBUS ISELIN	356		24°28.3'N, 77°29.5'W	1597	40' OT
BLAKE	2		23°14'N, 82°25'W	1472	
BLAKE	12		24°34'N, 83°16'W	66	
BLAKE	20		23°02.5'N, 83°11'W	402	

APPENDIX (continued)

Ship	Sta. no.	Date	Position	Depth (m)	Gear
BLAKE	21		23°02′N, 83°13′W	525	
BLAKE	36		23°13′N, 89°16′W	154	
BLAKE	43		24°08′N, 82°51′W	620	
BLAKE	44		25°33′N, 84°35′W	986	
BLAKE	47		28°42′N, 84°40′W	587	
BLAKE	62		off Havana	146	
BLAKE	230	2/20/1879	13°13.3′N, 61°18.8′W	848	
BLAKE	299	3/10/1879	13°05′N, 59°39.7′W	256	
ALBATROSS	871		off Martha's Vineyard	210	
ALBATROSS	2135	2/27/1884	19°55′58″N, 75°47′07″W	457	Tangle bar
ALBATROSS	2150	4/9/1884	13°34′45″N, 81°21′10″W	699	Dredge & Tangle bar
ALBATROSS	2311	1/5/1885	32°55′N, 77°54′W	144	Large Blake Trawl
ALBATROSS	2312	1/5/1885	32°55′N, 77°54′W	161	Large Blake Trawl
ALBATROSS	2313	1/5/1885	32°53′N, 77°53′W	181	Large Blake Trawl
ALBATROSS	2314	1/5/1885	32°43′N, 77°51′W	291	Large Blake Trawl
ALBATROSS	2384	3/3/1885	28°45′N, 88°15′30″W	1719	Large Blake Trawl
ALBATROSS	2398	3/14/1885	28°45′N, 86°26′W	415	Large Blake Trawl
ALBATROSS	2415	4/1/1885	30°44′N, 79°26′W	805	Large Blake Trawl
ALBATROSS	2417	4/2/1885	33°18′30″N, 77°07′W	174	Large Blake Trawl
ALBATROSS	2594	10/17/1885	35°01′N, 75°12′W	293	Large Blake Trawl
ALBATROSS	2602	10/18/1885	34°38′30″N, 75°33′30″W	227	Large Blake Trawl
ALBATROSS	2644	4/9/1886	25°40′N, 80°00′W	353	Blake Dredge
ALBATROSS	2654	5/2/1886	27°57′30″N, 77°27′30″W	1207	Large Blake Trawl
ALBATROSS	2668	5/5/1886	30°58′30″N, 79°38′30″W	538	Large Blake Trawl
ALBATROSS	2751	11/28/1887	16°54′N, 63°12′W	1257	Large Blake Trawl
ALBATROSS	2754	12/5/1887	11°40′N, 58°33′W	1609	Large Blake Trawl
JOHNSON-SMITHSONIAN EXPEDITION	10	2/2/33	18°29′20″N, 66°05′30″W	220–293	9′ Tangle
JOHNSON-SMITHSONIAN EXPEDITION	67	2/23/33	18°30′12″N, 65°45′48″W	329–512	4′ Dredge
JOHNSON-SMITHSONIAN EXPEDITION	93	3/2/33	18°38′00″N, 65°09′30″W	640–732	3′Dredge
JOHNSON-SMITHSONIAN EXPEDITION	94	3/2/33	18°37′45″N, 65°05′00″W	549–860	3′ Dredge
JOHNSON-SMITHSONIAN EXPEDITION	102	3/4/33	18°50′30″N, 64°43′00″W	165–914	35′ OT
JOHNSON-SMITHSONIAN EXPEDITION	104	3/7/33	18°30′40″N, 66°13′20″W	146–220	Oyster Trawl
ATLANTIS	1985		23°13′N, 81°22′W	704	
ATLANTIS	2963C	2/25/38	22°07′N, 81°08′W	375	35′ OT
ATLANTIS	2993	3/15/38	23°24′N, 80°44′W	1061	14′Blake Trawl
ATLANTIS	2999	3/17/38	23°10′N, 81°29′W	265–421	10′ Blake Trawl

[1]IKMT = Isaacs-Kidd Midwater Trawl; OT = Otter Trawl; Scal. Dr. = Scallop Dredge.